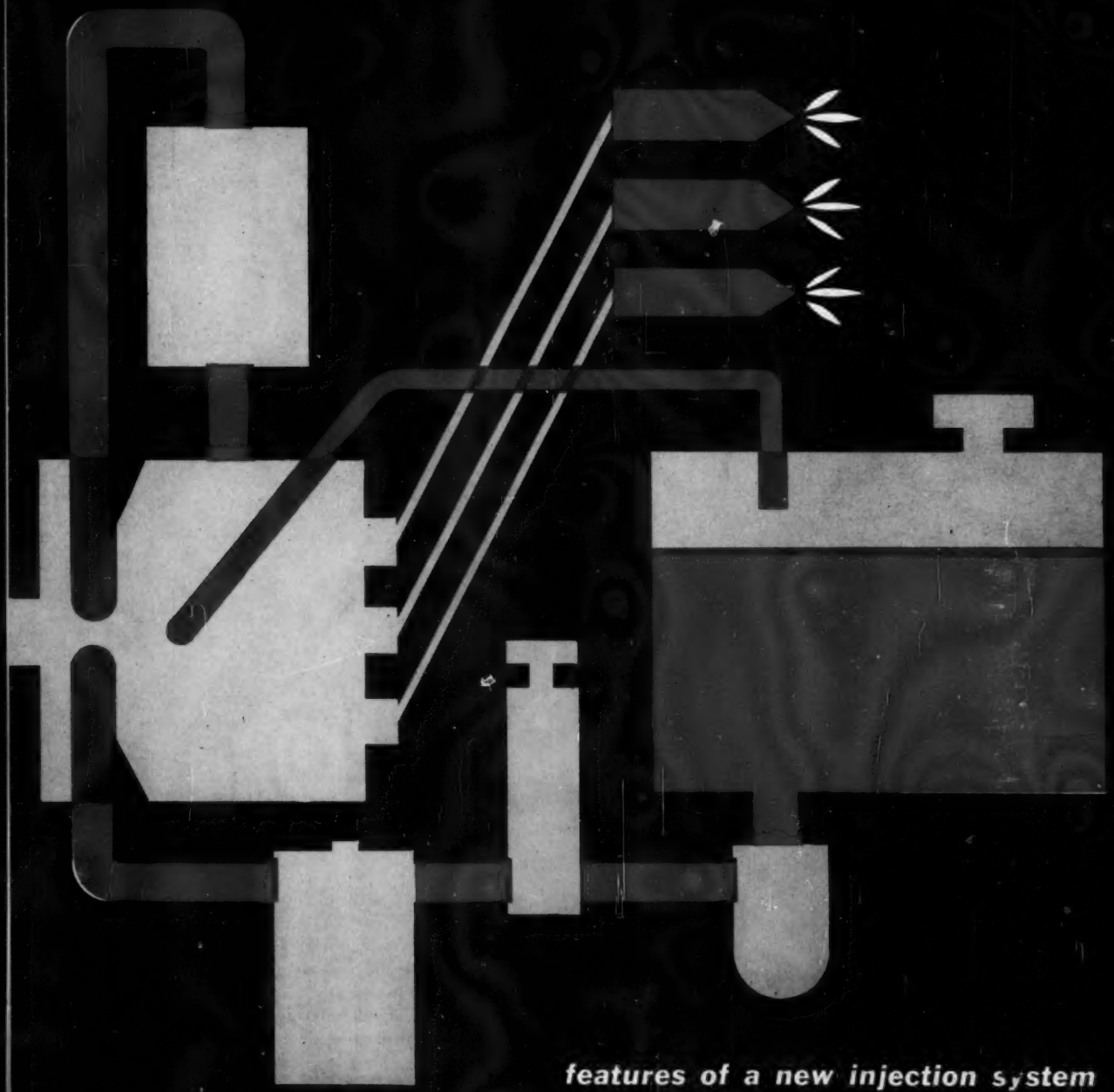
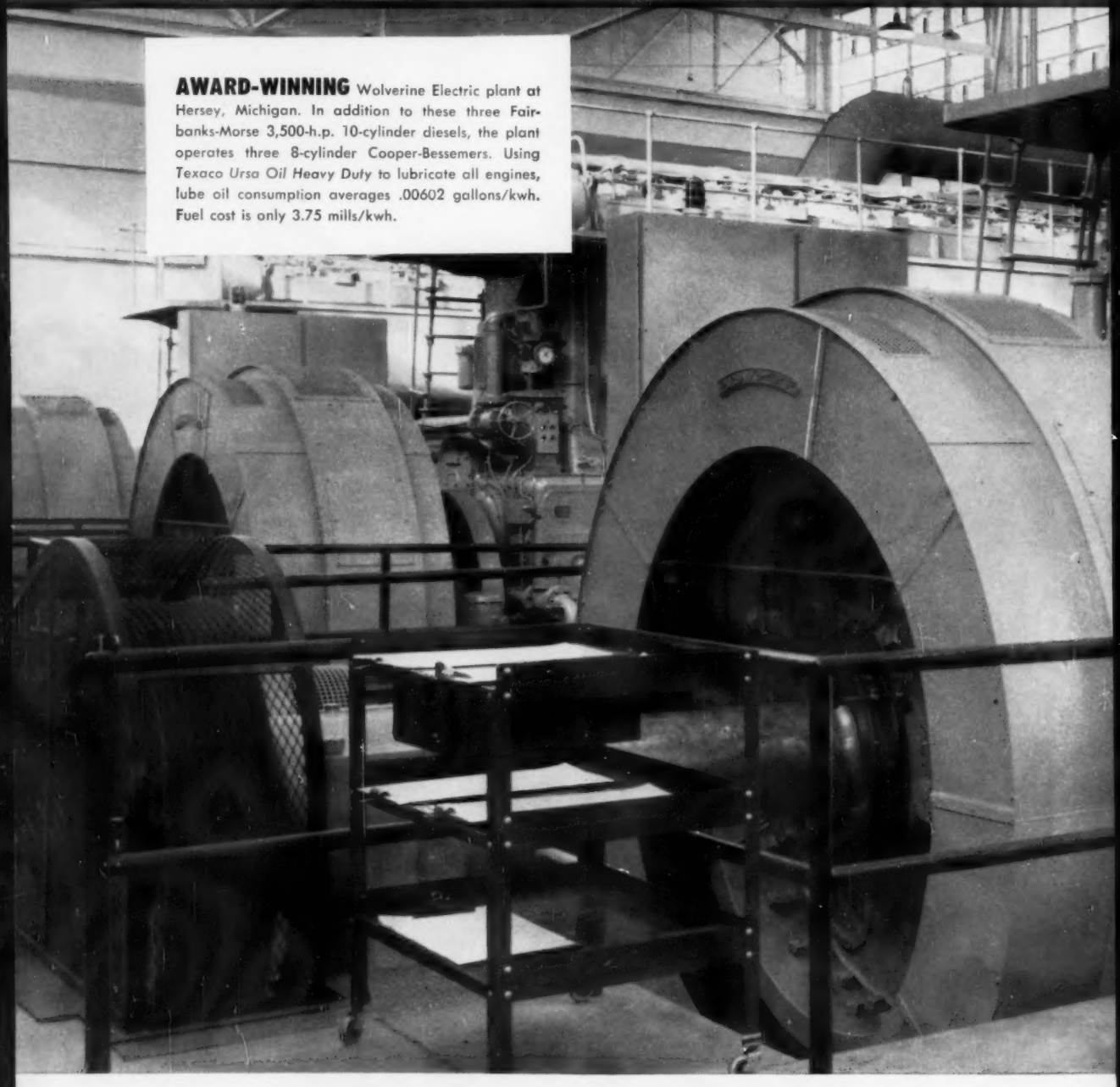
diesel power

February 1955



features of a new injection system

100% TEXACO-LUBRICATED PLANT WINS TWO



AWARD-WINNING Wolverine Electric plant at Hersey, Michigan. In addition to these three Fairbanks-Morse 3,500-h.p. 10-cylinder diesels, the plant operates three 8-cylinder Cooper-Bessemers. Using *Texaco Ursa Oil Heavy Duty* to lubricate all engines, lube oil consumption averages .00602 gallons/kwh. Fuel cost is only 3.75 mills/kwh.

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starring JIMMY DURANTE
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WOLVERINE ELECTRIC EFFICIENCY AWARDS

TWO YEARS in a row, the Wolverine Electric Co-operative's Johnson Plant at Hersey, Michigan, has won the coveted Diesel Progress award for efficient operation. An important factor in this success has been effective lubrication —*Texaco*.

All diesels in this Wolverine plant are lubricated with *Texaco Ursa Oil Heavy Duty*. This is one of the famous *Texaco Ursa Oil* series—*a complete line* of lubricating oils especially refined to make diesel, gas and dual-fuel engines deliver *more power* with *less fuel* over *longer periods* between overhauls. These benefits, consistently delivered, explain why—

For over 20 years, more stationary diesel h.p. in the U. S. has been lubricated with Texaco than with any other brand.

Let a Texaco Lubrication Engineer help *you* increase efficiency and reduce costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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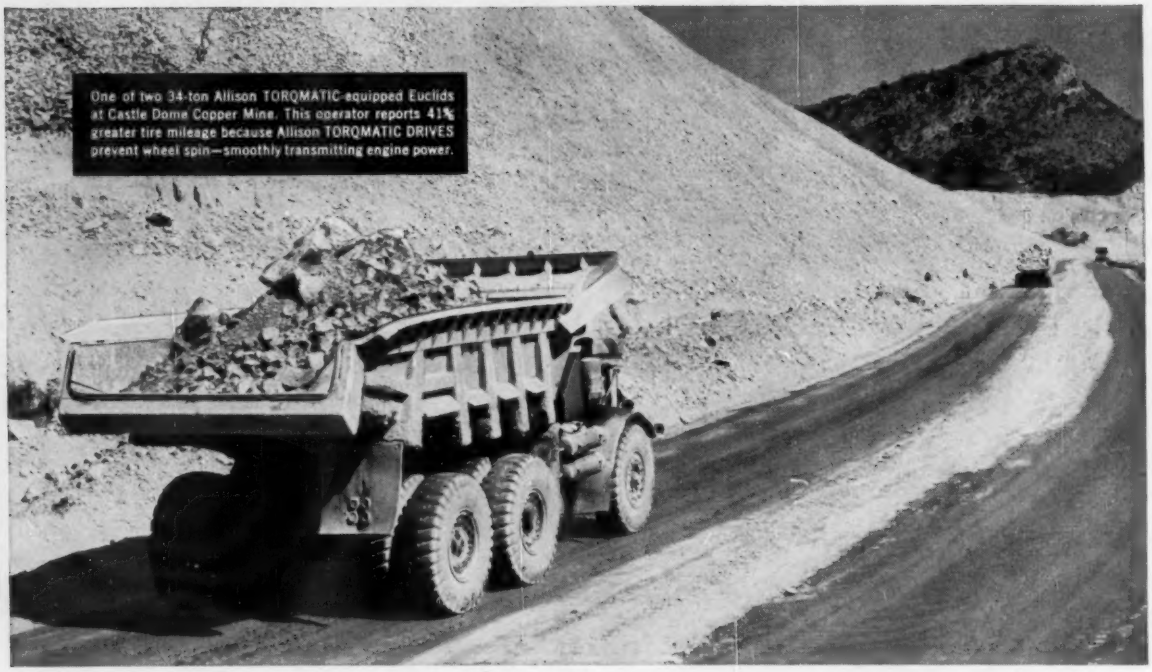
URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES



One of two 34-ton Allison TORQMATIC-equipped Euclids at Castle Dome Copper Mine. This operator reports 41% greater tire mileage because Allison TORQMATIC DRIVES prevent wheel spin—smoothly transmitting engine power.

"41% longer tire life"

Castle Dome Copper Company reports it gets 17,000 miles per tire on off-highway trucks equipped with Allison TORQMATIC DRIVES compared to 12,000 miles per tire on mechanical-drive units. But increased tire life is only part of the story — the firm also reports the TORQMATIC-equipped "Eucs" have better availability and production records.

This operator runs a fleet of 12 trucks —2 TORQMATIC-equipped "Eucs" and 10 mechanical-drive units — hauling 390,000 tons of ore and overburden per month up 8% grades on mile-long runs. The "Eucs" average 25.3 trips per 8-hour shift, each hauling about 58,000 tons per month.

TORQMATIC DRIVES smoothly transmit engine power—help prevent wheel spin that can quickly strip the tread from a tire. There's no clutch pedal to push and only three forward gear-shifts—instead of the usual 7 or 10 — handle all loads and grades. The *matched* converter-transmission team balances engine power and load demand, absorbs harmful drive-line shocks, prevents damage to drive-line components, helps stop engine lugging.

You, too, can cut your operating costs by specifying Allison TORQMATIC DRIVES the next time you buy. Ask your equipment dealer, manufacturer or write:

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Box 894S, Indianapolis 6, Indiana

ALLISON TORQMATIC DRIVES

Unbeatable Team for Maximum Operating Economy

- **Cuts** driver training costs
- **Quick-Shifts** at full throttle with finger-tip hydraulic control
- **Holds** power to load at all times — no clutch pedal to push—no gearshift guess
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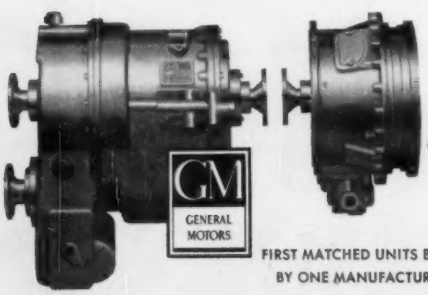
- **Only** torque converter-transmission team designed to work as a *unit* and built by one manufacturer



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diesel power

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CASE HISTORY NO. 541-61

USER: Bert C. Altfillisch, Contractor, Los Angeles, California.

INSTALLATION: 12 General Motors Diesel engines powering 6 HD-19 and 2 HD-20 Allis-Chalmers tractors and two Twin-Engine Euclid scrapers on flood control project in Los Angeles County, California.

PERFORMANCE: Twin-engine "Eucs," with 4 wheels driving, scrape 23-yard loads. Two units do work of three single-engine rigs, and required no pusher on this job.

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2 units do the work of 3

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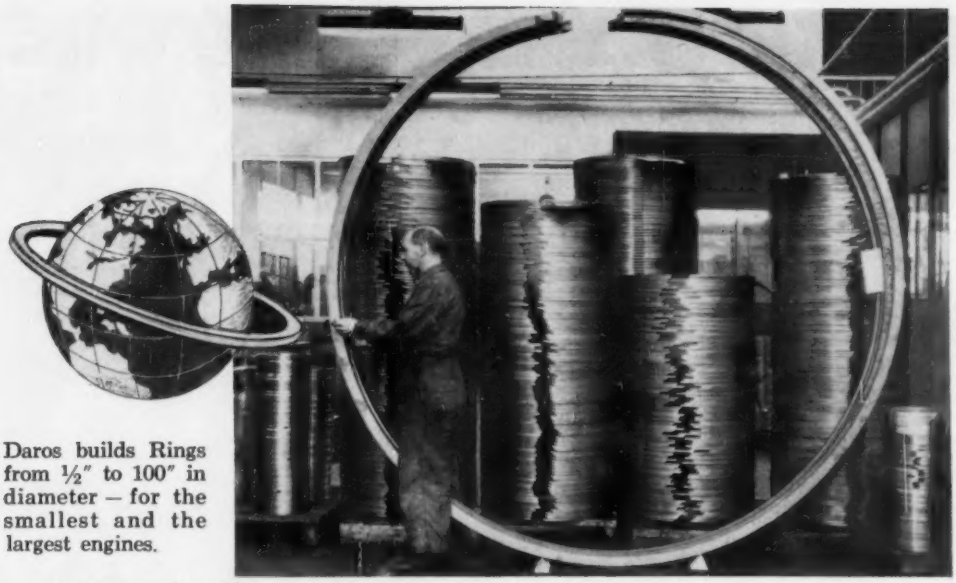

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(This is the second ad of a series designed to bring to Diesel Operators in the Western Hemisphere the important story about DaRoS Swedish Iron Rings– made by Ab. Davy Robertsons Maskinfabrik– Gothenburg, Sweden.)

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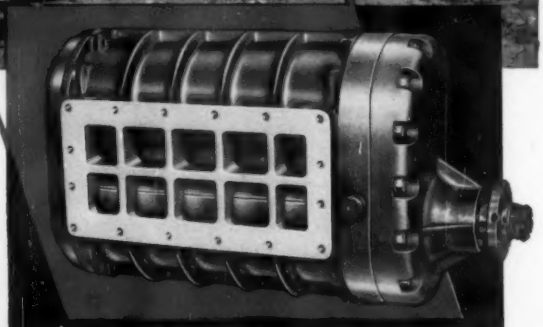

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The Engineer's Report

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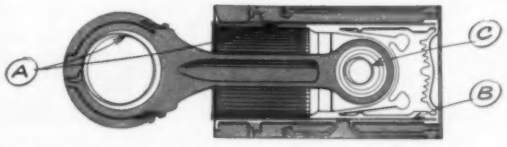

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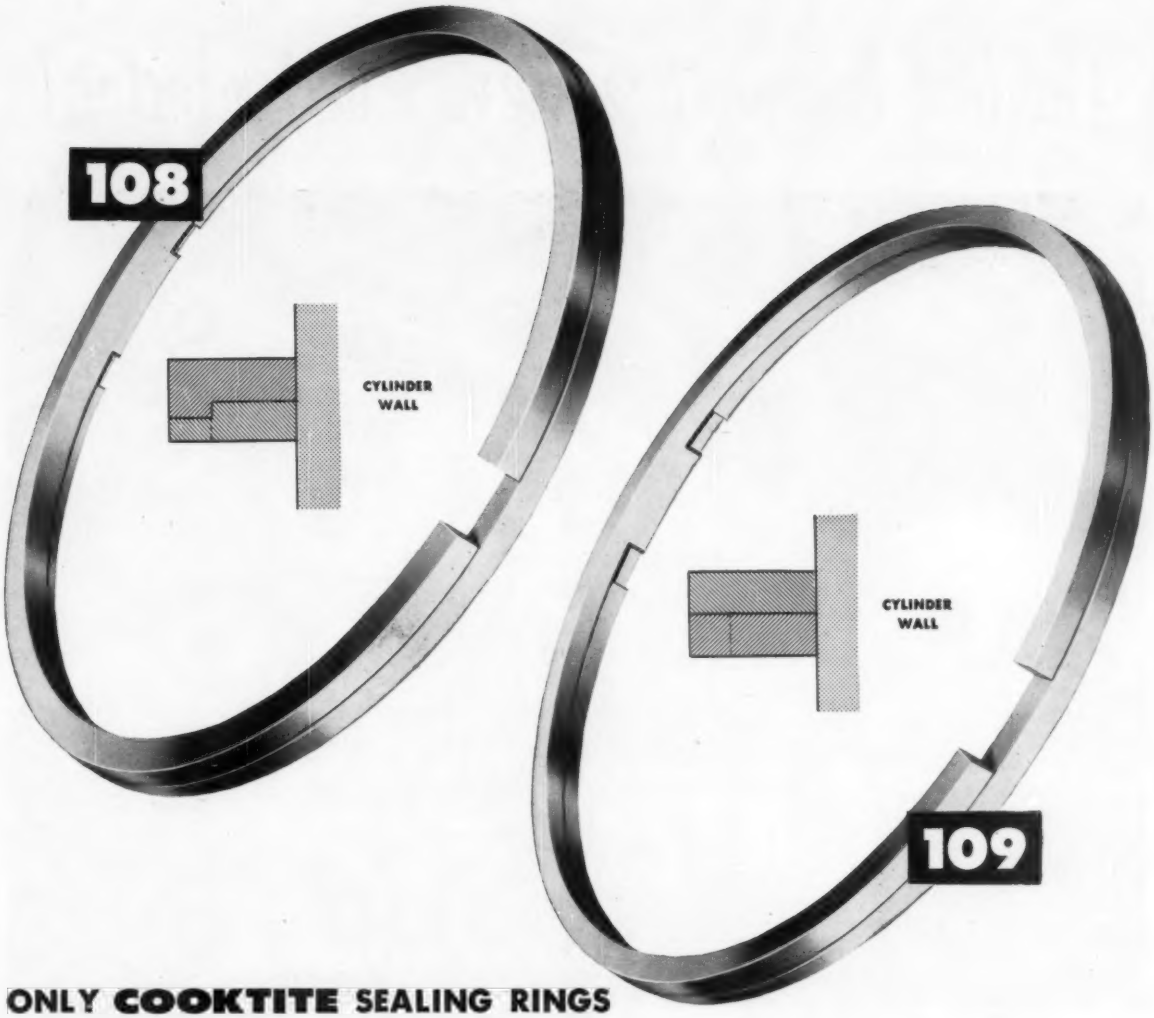

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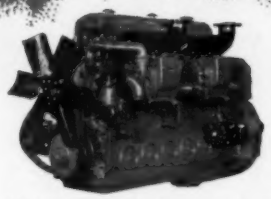
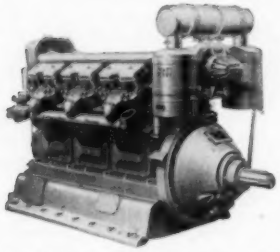
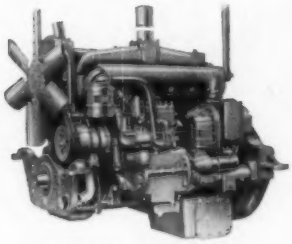


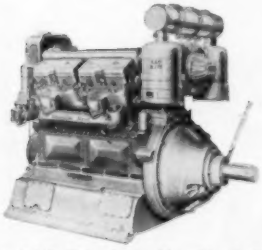
Model 687-C—Harnischfeger Corporation 6 cylinder, 2 cycle using two S-C superchargers.



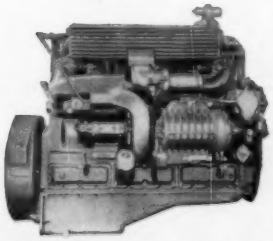
Model D-397—Caterpillar Industrial Diesel V-12.



Model D-337—6 cylinder—Caterpillar Diesel.



Model D-375—Caterpillar Diesel V8.



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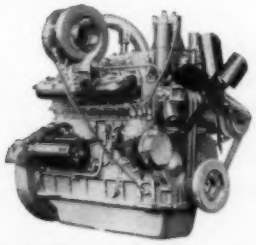
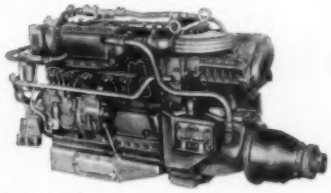
We can offer the last word in engineering assistance and the ability to produce efficiently.



Model 135-DKBS—Waukesha Motor Company with Schwitzer-Cummins Turbocharger.



Model DIX6ES—Hercules Motor Corporation Diesel with Schwitzer-Cummins Supercharger.

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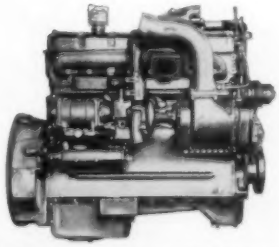

Model JBS-600—Cummins Engine Company, Inc. New High Speed Engine

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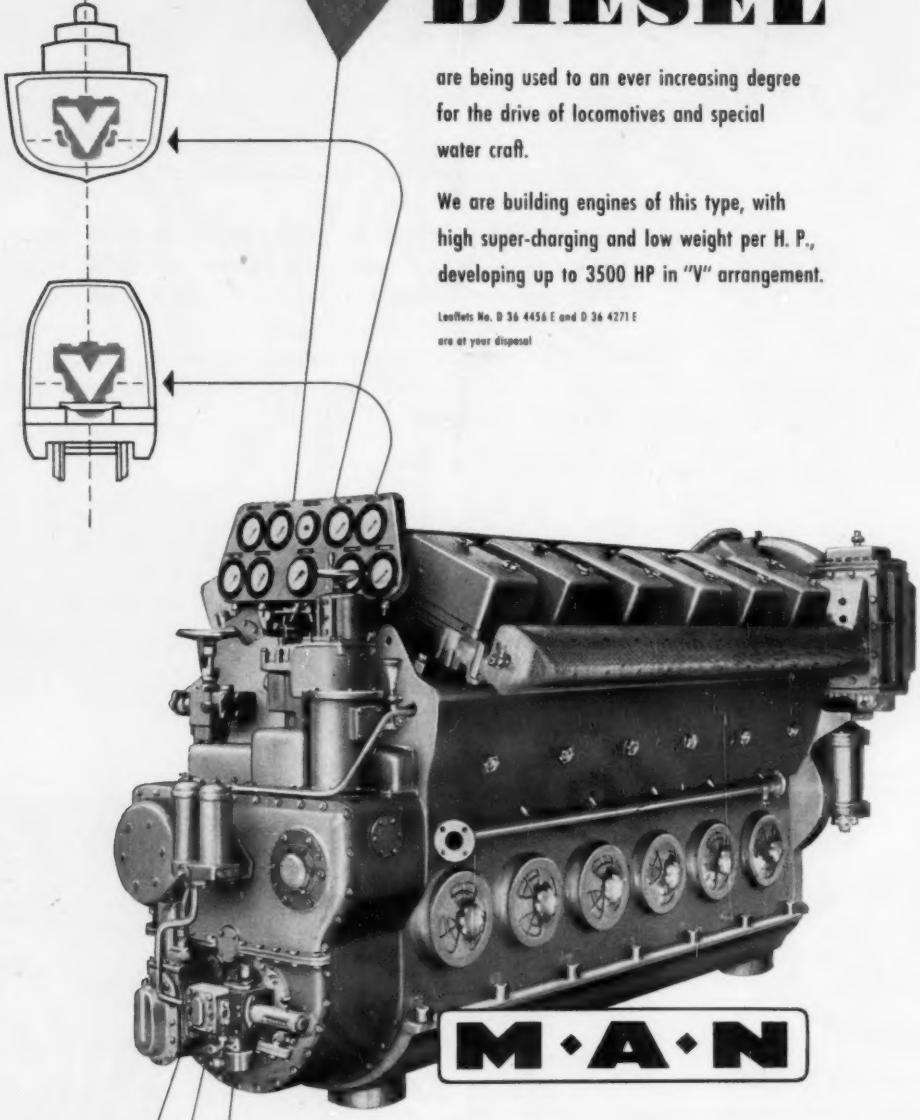

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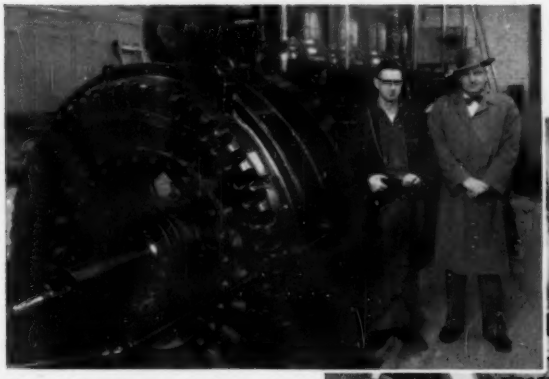
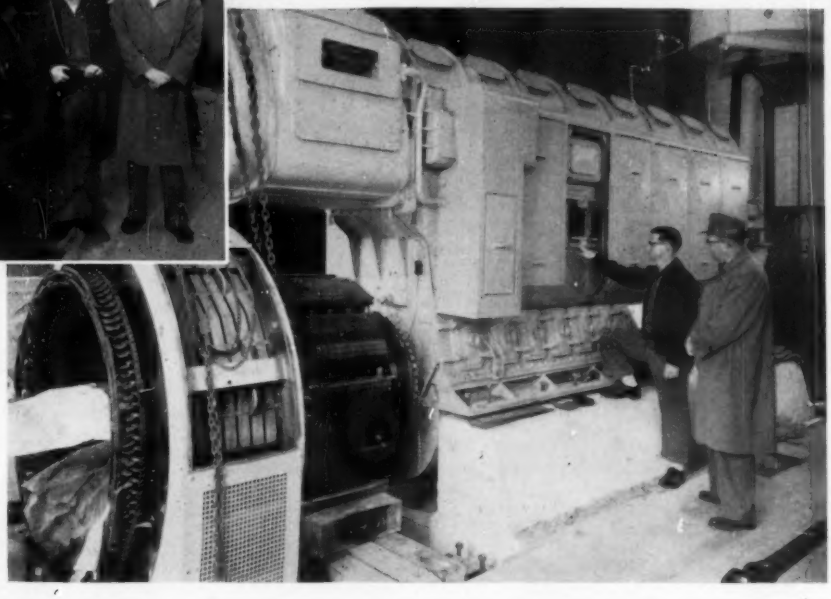


(Above) Mr. Chester W. Willin, Chief Engineer of Seaford Power and Light Company, Seaford, Delaware, and Mr. W. B. Graham, Pure Oil Branch Manager, beside 4-cylinder Fairbanks-Morse Diesel engine which has been operating smoothly and economically on Pure diesel lubricants for the past ten years.



(Right) Chief Engineer Willin shows W. B. Graham why they have selected Pure diesel lubricants for this new 12-cylinder Diesel being installed at the Seaford Power and Light Company.

...so Seaford selects Pure Oil Diesel Lubricants for new 12-cylinder engine

This Delaware city has been using Pure Oil diesel lubricants for ten years. They know—along with many others—that Pure diesel lubes are the *sure* way to keep engines running smoother, longer and with greater economy.

Pure Oil makes a complete line of quality diesel lubricating oils including: Purodiesel series, Purodiesel XD series, Sultana X series, Sultana SHD series, and Klondyke series. Each is tailored to meet the needs of a particular set of operating conditions while insuring easy reclamation and long use life.

Your local Pure Oil diesel expert will be glad to help you select the right Pure Oil diesel lubricant for your particular unit and operating conditions.

FREE used oil analysis foretells engine trouble... saves costly repairs

Don't guess about the condition of the lubricating oil in your engine. A pint sample of used oil subjected to Pure's analysis system will permit our technicians to determine this and report to you any need for adjustments. To get this FREE Pure-sure Used Oil Analysis, send coupon today!

Offer must be limited to the area where Pure Oil products are sold.

PURE — BE SURE WITH PURE

PURE OIL DIESEL LUBRICANTS

FREE BOOKLET

The Pure Oil Company, Dept. D-52
35 East Wacker Drive
Chicago 1, Illinois

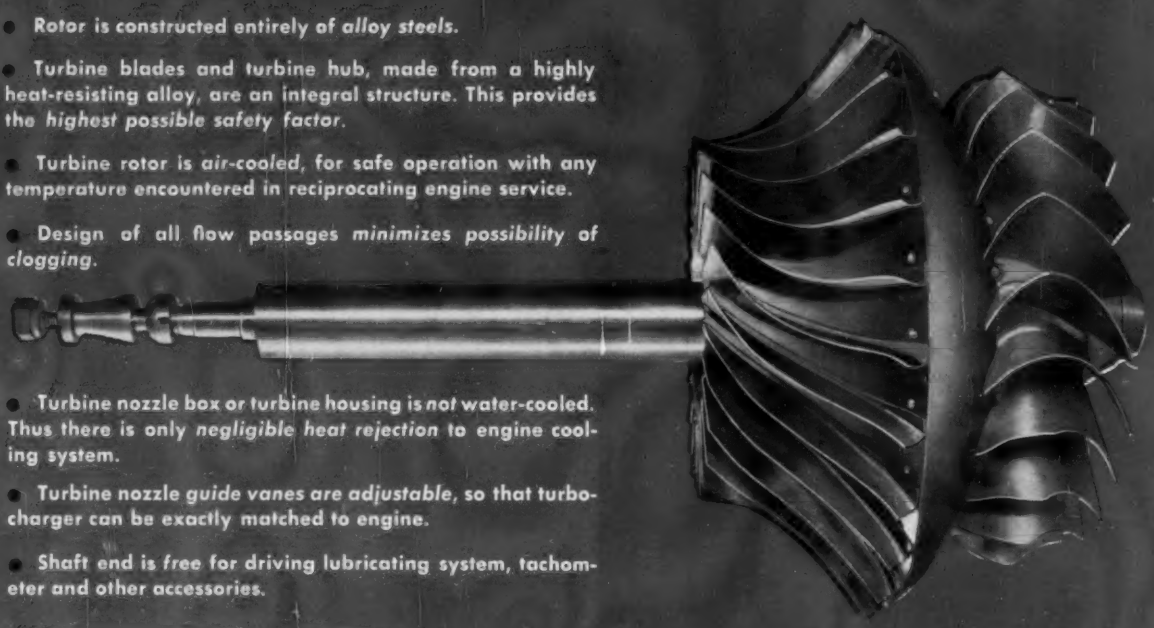
Send me information on how I may obtain a Pure-Sure Analysis of my used diesel lubricating oil without cost or obligation.

Name_____
Position_____
Company_____
Address_____
City_____ Zone_____ State_____

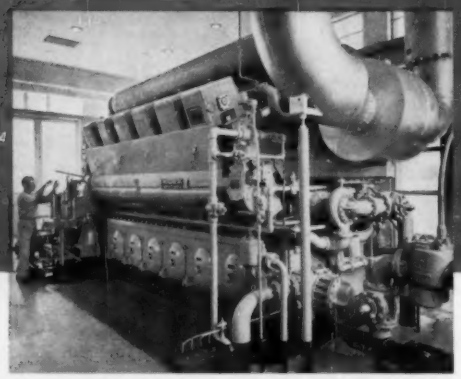
DE LAVAL
HIGH PRESSURE TURBOCHARGERS

increase output by 100% or more

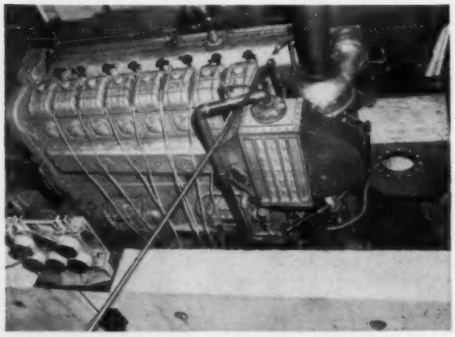
- Rotor is constructed entirely of *alloy steels.*
- Turbine blades and turbine hub, made from a highly heat-resisting alloy, are an integral structure. This provides the *highest possible safety factor.*
- Turbine rotor is *air-cooled,* for safe operation with any temperature encountered in reciprocating engine service.
- Design of all flow passages *minimizes possibility of clogging.*



- Turbine nozzle box or turbine housing is *not* water-cooled. Thus there is only *negligible heat rejection* to engine cooling system.
- Turbine nozzle *guide vanes are adjustable,* so that turbocharger can be exactly matched to engine.
- Shaft end is *free* for driving lubricating system, tachometer and other accessories.



Here is a De Laval Type A-14 Turbocharger installed on a V 12-cylinder, 4-cycle diesel engine.



A De Laval Type B-8 Turbocharger, shown on test, is mounted vertically on an 8-cylinder, 2-cycle diesel.

Exclusive
MONOROTOR
construction shows why

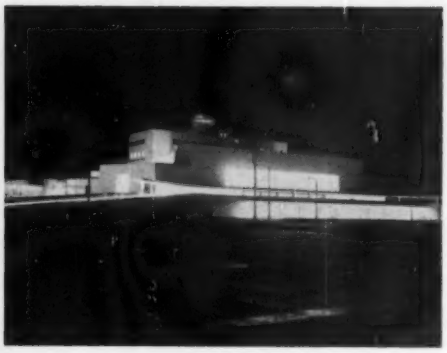
These De Laval high pressure turbochargers represent the newest development in diesel engine design. In many cases they can double the output of heavy-duty diesel, gas and dual-fuel engines without increasing thermal loading. • They offer pressure ratios of 3:1 as well as far higher compressor and turbine efficiencies than those found in conventional turbocharger systems. • De Laval turbochargers are self-adjusting to engine loads, can be used on 4- *and* 2-cycle engines. *Write for Bulletin 8000* giving compressor curves and flow range diagrams.

DE LAVAL

Turbochargers

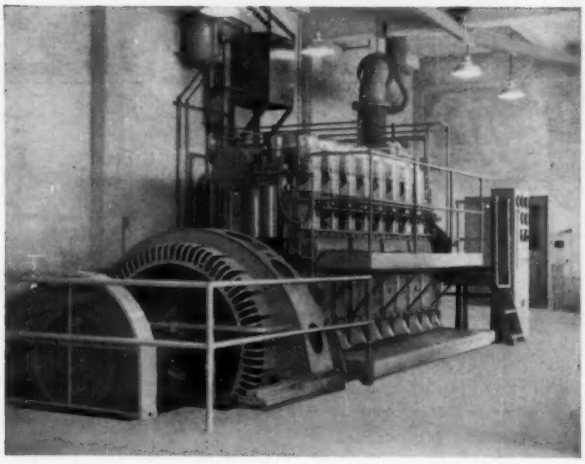
DE LAVAL STEAM TURBINE COMPANY
890 Nottingham Way, Trenton 2, New Jersey

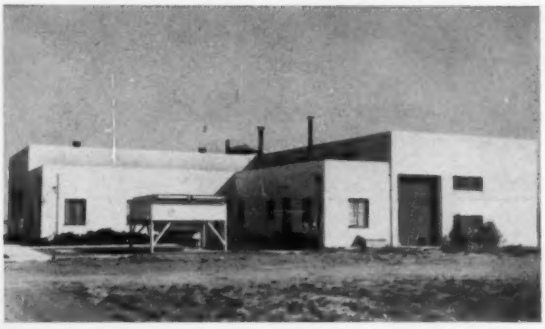
DL296



Enterprise emergency power guarantees immediate light for the control tower, runways, and more than 466,000 sq. ft. area in terminal building with its three concourses. Here, 27 loading stations serve 11 airlines.

No blackouts at San Francisco Airport with 1000 KW Enterprise standby unit





First fully automatic unit of its type in the U.S., this Enterprise standby plant also powers drainage pumps in case of airfield flooding.

Compactness of the Enterprise engine enabled easy installation in the existing building.

Power failure at this busy new $50,000,000 International Airport would create emergencies of major proportions. But with the Enterprise diesel-electric, *fully automatic* standby generator set now in operation, this will not happen. Within 13 seconds, if power fails, the Enterprise cuts in to supply all the power needed for normal operation of control tower, runway lights, and other essential airport facilities.

Enterprise Engines serve every municipal power need. You'll find these dependable engines ideally suited for stationary or portable electric generating plants... flood or water supply pumping systems... or for powering sewage disposal plants. Contact the Enterprise sales office in your area today, or write us direct about your problem.

Further proof of Enterprise adaptability and vibration-free operation is shown by the use of the concrete cradle which was an integral part of the building.

Over a million horsepower at work the world over!

ENTERPRISE dependable ENGINES

THE SWITCH IS TO ENTERPRISE
CHOICE OF POWER EXPERTS

ENTERPRISE ENGINE & MACHINERY CO. • **Subsidiary of General Metals Corporation** • **18th and Florida Streets, San Francisco 10, California**

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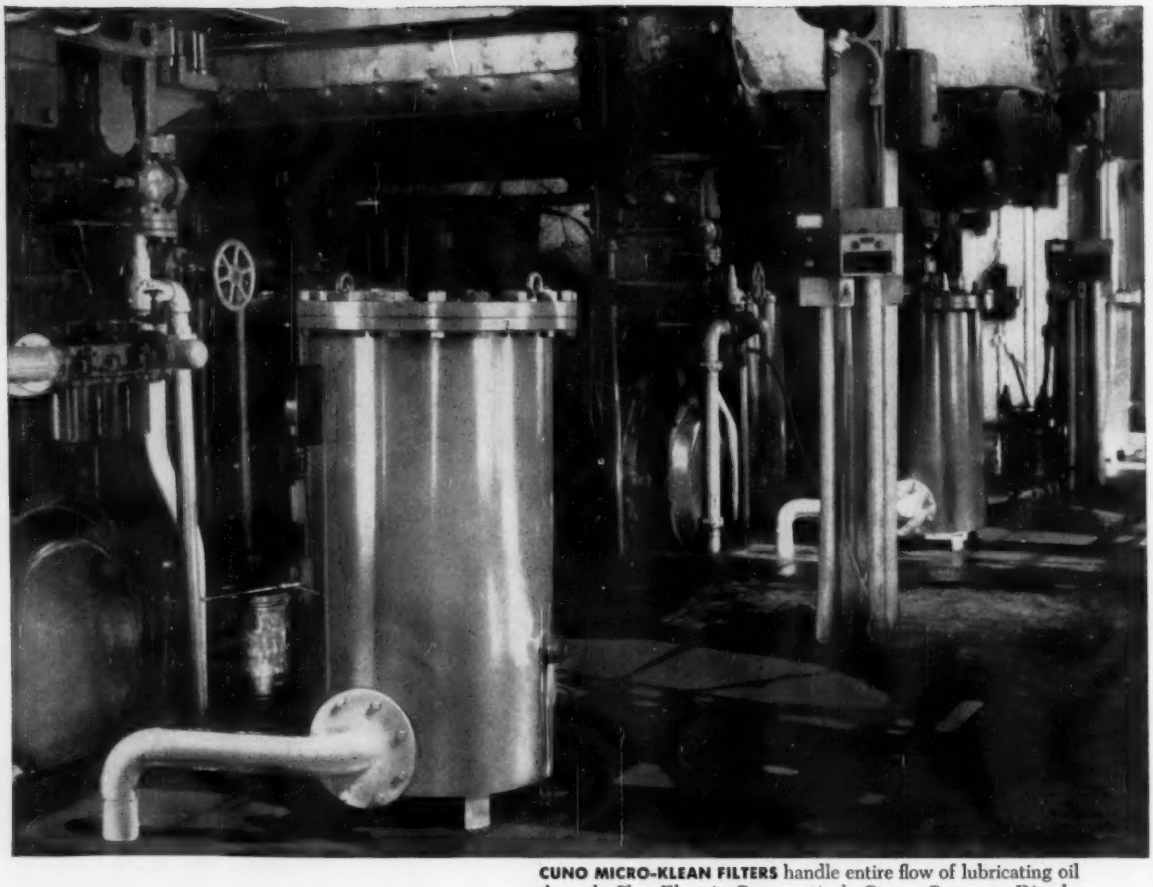


CUNO MICRO-KLEAN FILTERS handle entire flow of lubricating oil through Clay Electric Co-operative's Cooper-Bessemer Diesels.

How Florida electric utility knocked 25% off power production costs

We're talking about the Clay Electric Co-operative, Inc., in Keystone Heights, Florida.

In 1950, when they were burning distillate oil in their five Cooper-Bessemer Diesels, Clay's cost per kilowatt-hour was 9.914 mills. Switching to Bunker C oil in 1953 brought production costs down to 7.629 mills per kilowatt-hour. That's practically 25% in any man's language.

Our part in this success story? Cuno MICRO-KLEAN filters handle the tough job of filtering the entire flow (150 gpm) of lubricating oil through each Cooper-Bessemer. And according to Robert Dodd, Chief Engineer at Clay, the MICRO-KLEAN's are just right. Here's what he says: *"We're very pleased with the performance of the* MICRO-KLEANS. *They're very definitely assisting in making our success possible."* Mr. Dodd goes on: *"I heartily endorse your* MICRO-KLEAN *filters for lube oil service – they fully protect the engine from dirt particles. Trying to cut corners on filters can be false economy of the worst kind."* We agree, Mr. Dodd.

Want to know how MICRO-KLEAN can help solve *your* lube oil problem? Write us today for free MICRO-KLEAN bulletin. Cuno Engineering Corporation, Department 25, South Vine Street, Meriden, Connecticut. 4.11

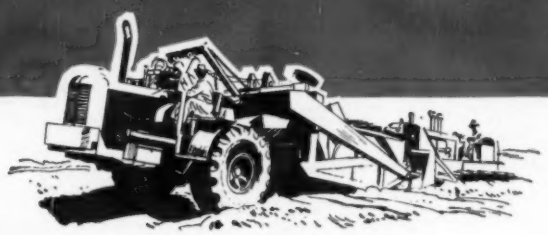
CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) · MICRO-KLEAN (fibre cartridge) · FLO-KLEAN (wire-wound)

Longer diesel life in toughest lugging service ...with Clevite* 77's



EXTREMELY hard work, day in, day out, is the rule for a fleet of "Terra Cobras" operated by one of the largest heavy-duty earth-moving contractors in Southern California.

These units, equipped with Clevite 77 bearings, drag earth scoops that excavate and haul an average 25-ton load with each run over the area being worked. This results in an engine speed variation, under full load, from a high of 1800 rpm to a lugging speed of 600 rpm.

But in spite of this severe speed variation and unusually rough going in general, Clevite 77's enable the company's diesels to average a hoped for 2-year service life.

As evidenced here, you can always count on the original equipment engineering and quality of Clevite 77's.

Distributed by N. A. P. A. jobbers, they are available nationwide.

Your NAPA Jobber is a Good Man to Know!

NAPA Assurance of Quality

*The words Monmouth, Clevite and Micro are registered trade marks of Clevite Corporation.

Monmouth TRADE MARK ENGINE BEARINGS

Clevite Service—The Cleveland Graphite Bronze Co.—Division of Clevite Corporation, Cleveland, Ohio, U. S. A.

County Courthouse, Newkirk, Oklahoma

Where does the Court get its power?

For seven years in Newkirk, Oklahoma, one powerful machine controlled the power of the court...a Fulton 800 H.P. dual-fuel generating unit, lubricated by Cities Service Pacemaker #5 Oil.

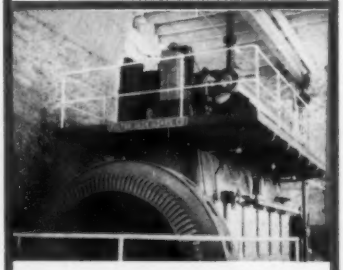
But it wasn't only the court that depended upon this one machine . . . the entire town relied upon it. If the machine failed, so might the annual grain harvest, for Newkirk's grain elevators require great quantities of power.

BUT THE FULTON GENERATING UNIT AND CITIES SERVICE LUBRICATION PROVIDED FAULTLESS SERVICE. There was never a breakdown.

Newkirk's power boss, Superintendent of Utilities Ralph E. Cottrell, sums it up this way: "Using Pacemaker #5 in the engine's crankcase and cylinder lubricators, we not only enjoyed trouble-free operation during those seven years, but also surprisingly little wear and oil consumption. Rings, bearings and liners remained in top notch condition and the engine piled up well in excess of 6000 horsepower hours per gallon of oil."

This is but one more powerful story of Cities Service Lubrication . . . a graphic illustration of the kind of results you can expect from these highest quality lubricants. Why not get the whole story from a Cities Service Lubrication Engineer? Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

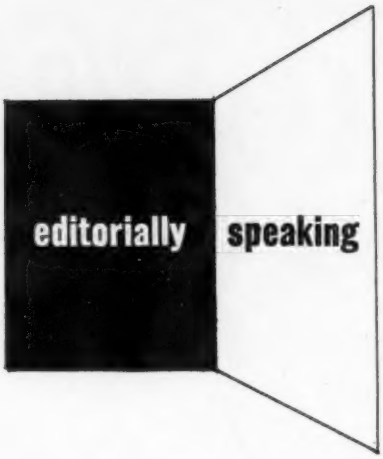
Ralph E. Cottrell, Power Boss of Newkirk, Oklahoma. All of Newkirk depends on him as Supt. of Utilities. He depends on Cities Service Lubricants for town's power generators.



Powerful Machine Behind The Court is this Fulton 800 H.P. dual-fuel generating unit. For seven years Newkirk's only major power source, it gave "faultless performance" using Cities Service Lubricants.

CITIES SERVICE

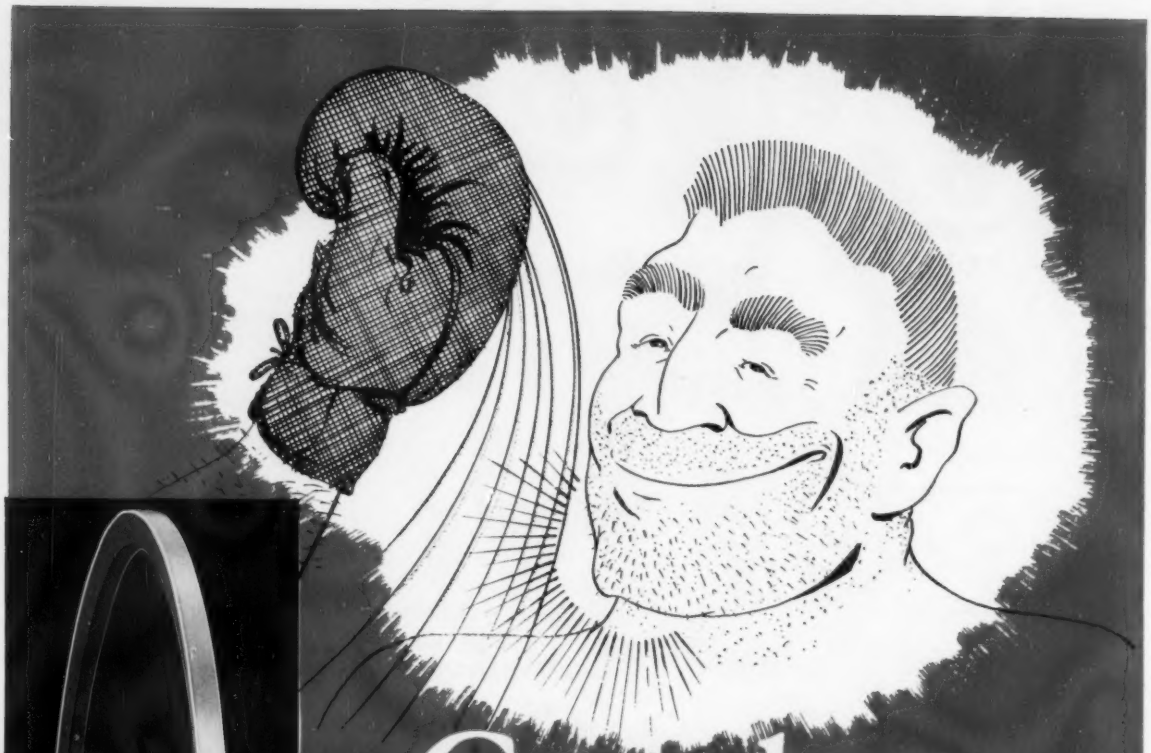
QUALITY PETROLEUM PRODUCTS



The Census of Manufactures

Should I? Or shouldn't I? And if so, how far? Decisions, decisions, always decisions. That's modern business where decisions must be based on fact not fancy. Facts are guide posts that influence every phase of business and industrial activity from capital investment commitments to merchandising programs. And our industry is no exception. There must be a basis for planning from the engine builder right on down through the accessory manufacturers and different types of suppliers. They are all integrated and interdependent. No one is going to commit a dime for research, engineering and production facilities—all things that vitalize an industry—unless he has a pretty good idea that his sales volume and profit margin will yield a return. Take a look at the automotive industry. It is one of the most alert and progressive industries around today. It is also one of the best documented. Don't think for a minute that this is coincidence; it just ain't so. They have spent literally millions to get facts. Want to know how many cars in the order of preference are in Calabash county? You can find out. Multiply this by all the counties, relate it several ways, and you have valuable facts on which to predicate production and sales efforts. This is perhaps the ultimate; few industries can afford or even need such detailed data. But they do need basic facts. At least breakdowns of production figures. This is where the Census of Manufactures comes in. The Department of Commerce foresaw the need for a central clearinghouse for such data back in 1810 when the first Census of Manufactures was taken. The most recent was 1947. Another is now in progress. The Census Bureau is charged with collecting and correlating this data, but it must have industry's cooperation. Not from one company, but from all. This puts the bee on everyone. We all need this data. It is the rock-bottom foundation underlying any intelligent planning. You've all asked for information but you can't expect to get it unless you give your share. And don't be like the fellows that are still sending in their forms for the 1947 census. (It's a fact.) Get them in completely and early. You'll be helping your industry and therefore yourself.

BPE



Cyclan

RING IRON

has extra high impact value for shock resistance!

- Combines the best characteristics of iron and steel.
- Equals or surpasses the wearing quality of cast iron.
- Approximates the strength of steel.
- Retains true shape even after much deflection.
- Stands up in super-charged engines.
- Can be readily chrome-plated.
- Functions efficiently without chrome plating.
- Has high resilience—excellent bearing characteristics.
- Now used for original equipment in heavy-duty engines.
- Now available for replacement use.

Cyclan is exclusively a Sealed Power development

Write for "The Cyclan Story"

Sealed Power

PISTON RINGS · PISTONS
CYLINDER SLEEVES

SEALED POWER
CORPORATION
MUSKEGON, MICH.

highlights

- AAR tells us that during 1954, American railroad spent $485 million for new equipment which included nearly 29,000 new freight cars and 1070 new locomotive units.

- Canadian Car and Foundry Company, Ltd., has received an order for 100 diesel-powered buses from the Montreal Transportation Commission. It is reportedly the largest single order of its kind in Canada. Delivery is scheduled to start in April.

- Construction of a modern diesel service shop has been started by the Canadian Pacific Railroad at its St. Luc yards. The new shop, which is expected to be in operation this summer, will have an area of approximately 20,000 sq ft.

- Early last month, the Union Pacific's City of Saline puffed its way into Kansas City for the last time. Union Station in Kansas City will be served with diesel locomotives from now on.

- The National Highway Users Conference reported that diversion of state highway use taxes to non-highway purposes totaled $294,076,000 in 1953. In the 26 states found diverting funds, more than 13 cents of every highway use tax dollar went for purposes totally unrelated to highways.

- Rock Island's "Jet Rocket", a Talgo-type streamliner, will shortly be put into production by ACF. The 1200-hp locomotive will also house auxiliary diesel sets which will provide light, heat, and air conditioning for the train. Delivery is expected sometime in December.

- Cummins reports the expansion of service facilities will take place during 1955. The current program calls for additional service points throughout the United States and Canada. Research facilities at the company's Columbus, Indiana factory have been expanded about 60% over the past few years as part of a $7 million improvement and expansion program.

- As of December 1st, 1954, Class I railroads had a total of 148 diesel-electric locomotive units on order. This is in contrast to the 634 diesel-electric locomotive units on order on the same date in 1953.

- At the beginning of 1954, U. S. reserves of liquid hydrocarbons amounted to 34.4 billion bbl, an all-time high. Proved reserves of liquid petroleum and natural gas were believed to have moved to new peaks during 1954.

- The American Society of Lubrication Engineers will hold its annual meeting at the Hotel Sherman in Chicago, Ill., April 13, 14, & 15, 1955. Already scheduled are 41 papers to be presented in 16 sessions.

- A highlight of the 17th annual American Power Conference will be the discussion of the progress being made to harness nuclear energy for the mass production of electrical energy. The place will be the Hotel Sherman—the date—March 30 through April 1, 1955.

- According to the annual report of the Hawker Siddeley Group, makers of the Armstrong Siddeley diesels, extensive tests are being carried on by Massey-Harris and International Harvester to fit these engines as standard diesel equipment for baling machines.

- One of California's biggest oil well drilling rigs, which can tap pools of oil 15,000-ft below the earth's surface, is powered by 18 GM diesel engines providing a total of 2300 hp.

- According to the American Road Builders Association, ". . . the current $4 billion highway improvement program requires some 250,000 units of construction machinery and allied equipment." This is based on extensive inventories of contractors' on-site equipment, replacement factors, and trends in equipment developments, the ARBA tells us.

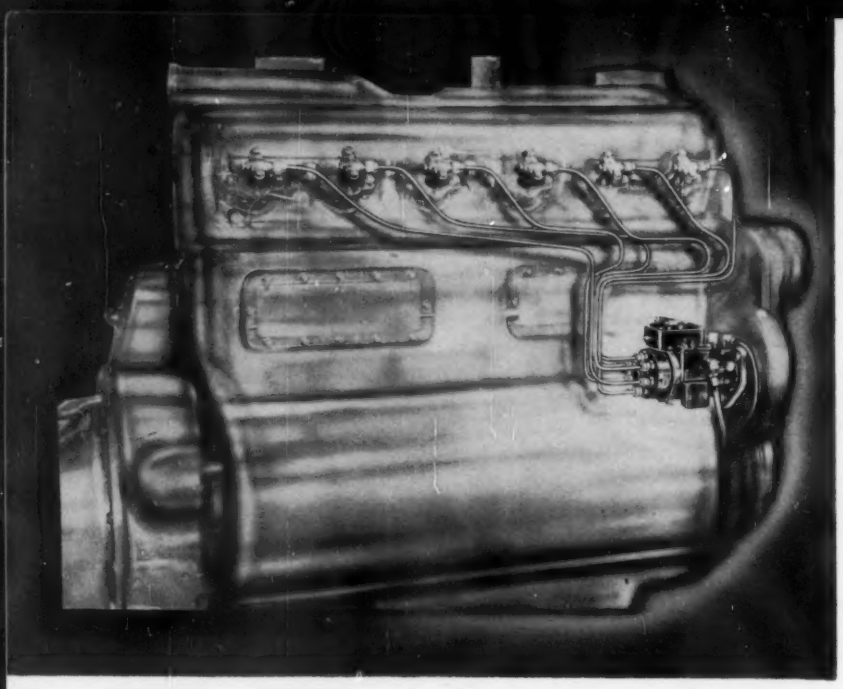


Fig. 1 Illustrating the comparative size of flange-mounted pump on an engine which requires maximum fuel capacity of the pump.

Bosch's New Fuel Injection System

Modern engine design trends and today's economics accentuate the need for lower cost, smaller, simpler, and more flexible fuel injection systems. The PDA fuel injection pump and ADE nozzles are American Bosch's latest contribution in this direction.

IF you had to bring the cost of a modern high-speed diesel down to the lowest differential with that of a comparable gasoline or LPG engine, chances are that you would take a long look at the fuel injection system. Its cost has historically been higher than its counterpart, the ignition system and carburetor. Certainly this is a target area in any move to reduce diesel costs.

While cost reduction is incentive enough, the modern diesel design trends add further impetus. Design objectives seek to increase the output through higher cylinder pressures and increased rotational speed. In short, the diesel is closely approaching its competitors in size and weight for comparable outputs. This places new demands on the fuel injection system.

Size and weight of injection equipment become important physical factors. Operational requirements and the higher engine speeds demand flexibility with precise, economical functioning at the ever-increasing rpm. In addition to low initial cost, simplicity is a goal so as to achieve easy and low-cost maintenance.

We have had excellent fuel injection equipment for many years. But excellence is not necessarily synonymous with all the other qualities demanded by today's needs. There has been an evolutionary—one might even say revolutionary—process of thinking in the field of injection equipment, with the result that today's systems fit today's needs. The fact that the added requirements are being attained with no sacrifice in performance is daily attested in field service.

American Bosch's new fuel injection system, featuring the PDA pump and a simplified ADE nozzle and holder, is the most recent exposition of this thinking. They have been keenly aware of the needs and trends in the field for a good many years. Feeling that the single-plunger pump or distributor-type pump was inherently less expensive and offered good potentialities, they instituted a continuing development program in 1939 that was interrupted only by the war years.

Commercial introduction of the PSB single-plunger pump in 1950 was an outgrowth of this program. This pump contributed greatly to expansion of the small diesel engine usage, notably in the wheel-type farm tractor field. Nearly 75,000 of these units have been built.

Recognizing the rapidly changing and more exacting needs, as well as anticipating future ones, further development resulted in the PDA pump. The overall con-

cept is somewhat different from other American Bosch designs, but it embodies three principles common to all of them. First, plunger acceleration takes place before injection starts; second, injection starts with bypass port closing; and third, it ends by uncovering a spill port.

In addition, design objectives included the following that had to be all wrapped up in an economical package:

(a) capability to function at very high speed
(b) provision for automatic, manual, or fixed timing
(c) must provide 100% excess fuel for starting
(d) have torque control governing
(e) permit flange, base, or the new shank mounting
(f) must adapt to 8-cyl engines.
(g) inability to inject during reversed rotation.

General Description

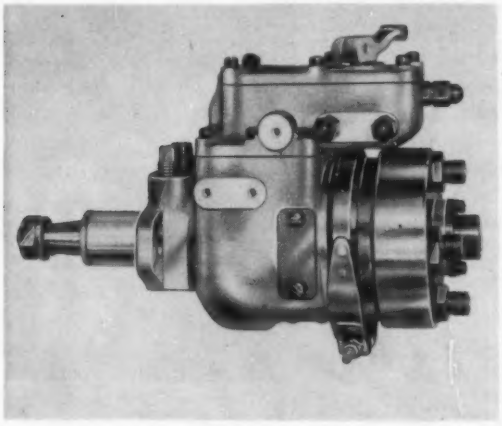
The PDA is a compact distributor-type unit operating at camshaft speed. In its initial or "A" size it is being recommended for use on engines that require up to 130 cu mm of fuel per stroke. As a yardstick this would be adequate for full-load condition of a normally aspirated engine up to about 130 cu in displacement per cyl, or say, roughly 5¼-in by 6-in bore and stroke.

Externally, the pump consists of a main housing, a distributing head, a rotor shaft, and a small housing for the governor linkage. The supply pump, governor, pumping mechanism, and control sleeve are all housed within the unit. The entire pump is filled with fuel oil delivered from a final-stage filter to the pump interior at between 5 to 10 psi. This is the fuel for delivery but it has an additional function of lubricating all the moving parts.

Take a good look at Fig. 3. Some governor parts and the supply pump (illustrated elsewhere) have been deleted from this cross-section to show the metering and pumping components more clearly. Considering the rotor shaft axially from left to right, the first section (A) is where metering takes place. The rotor shaft, control sleeve (E), and the governor (not shown) are involved.

Moving to the right, we come to the pumping section (B). The plungers (F) are radially mounted in the rotor shaft. Their outer ends bear on shoes and rollers (G) with the rollers in contact with an internal cam ring (H). Thus as the rotor shaft turns, the plungers are reciprocated by the cam lobes. The cams are symmetrical to impart a smooth reciprocating motion at even the highest pump speeds.

At the right is the distributing section (C). A discharge or delivery valve is located in the shaft bore and serves to relieve line pressures after injection stops. During shaft rotation, a passage in the rotor indexes successively with the line fittings which are connected by high-pressure lines to the nozzles in the proper firing order. Note that filling of the rotor shaft takes place in the distributing section (passages shown in registry) where it is least affected by fuel spill in the metering section.



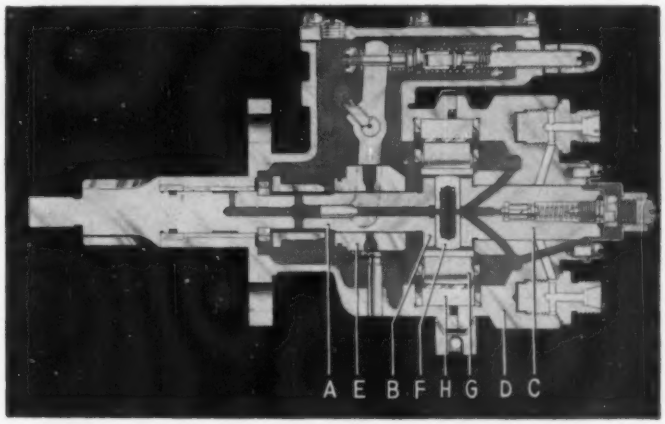


Fig. 2 The basic flange-mounted pump with governor, supply pump, and fixed timing. Control lever is at top. In cross section at right, internal parts (some governor parts and the supply pump have been deleted) are shown in filling position.

A—Metering section
B—Pumping section
C—Distributing section
D—Distributing head
E—Control sleeve
F—Plungers
G—Shoes and rollers
H—Internal cam

The Metering Process

Arrangement of the fill passages is such that they are open during the full period of the outward or filling stroke of the plungers. This assures complete filling at even very low supply pressures. Further shaft rotation closes the fill ports and the plungers begin acceleration up the cam ramps for the start of the injection stroke. Refer now to Fig. 4.

Remember that American Bosch adheres to the principle of port closing for starting injection and port opening for spill. The phantom view of the rotor shaft and control sleeve shows the arrangement for doing this with rotary motion. During the start of plunger acceleration (American Bosch's third principle), the longer slot in the rotor registers with the stationary control sleeve hole and allows fuel to be displaced back to the supply.

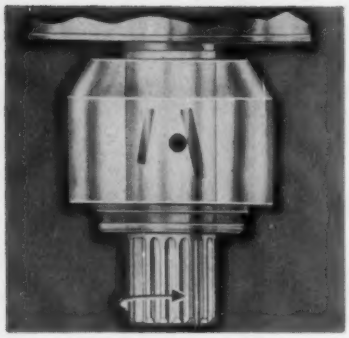


Fig. 4 Port closing

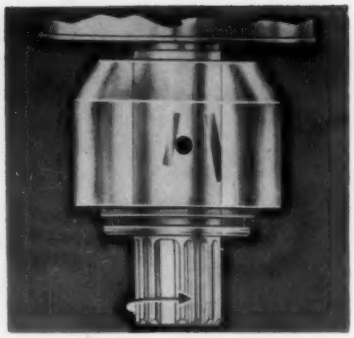


Fig. 5 Port opening

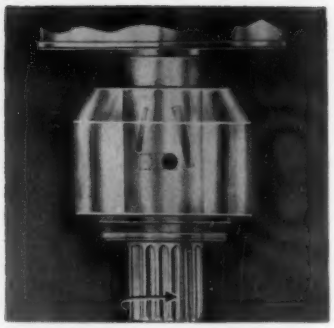


Fig. 6 Sleeve location for starting

As shown (Fig. 4), the larger slot has reached port closing and injection is just beginning. When the shorter slot reaches the position shown in Fig. 5, spill occurs and injection ends. The angular travel between these two positions represents the duration of injection. Because of the angularity of the slots, upward sleeve movement reduces the period of injection and hence the quantity delivered. Downward movement has the opposite effect.

Note at this time that the spill slot is shorter than the closing slot. This arrangement is for meeting the starting requirement for 100% excess fuel. When the sleeve is moved downward to the point shown (Fig. 6), the spill port does not function with the result that injection continues up to the end of plunger stroke.

Another point, elaborated later, concerns changes in timing of the start of injection. Due to the angularity of the closing slot, it can be seen that as delivery quantities decrease, the start of injection occurs a little later and provides timing change for *load* variation. Timing variations in either advance or retard can be obtained and without effect on the fuel quantity delivered, by rotary movement of the control sleeve. This is used for timing variations with respect to *speed*.

In all cases, delivery starts as soon as the control sleeve port is closed. Plunger stroke is fixed by the height of the cam lobes. The metering process, as described, determines what portion becomes the effective stroke. As pressure is developed, the delivery valve is lifted and fuel flows through the delivery passage to the line fitting that is in register at that time. At the end of injection, the delivery valve reseats and through action of the relief piston incorporated in American Bosch valves of this type, line pressure is relieved.

Governing

A simple ball and single-cone type governor is used. (Fig. 7) The cone is attached right to the control sleeve, eliminating all linkages. Drive comes from the pump drive shaft through splines (A) and a torsional vibration-absorbing member (B). Six balls (C) driven by the ball cage bear against the thrust bearing (D) and the cone (E), forcing the cone and attached metering sleeve to the right with speed increase. A fulcrum lever (F) is linked to the control sleeve by means of a pin (G) engaging the sleeve slot (H). The other end of the fulcrum lever connects with the governor tension spring (K) which hooks to the manual operating shaft (J). As shown, the governor is in idling position with the spring carrier bearing against the idle screw (L). The high-speed stop adjustment screw (M) is just to the right.

Attached to the lever is the resilient stop (P) used for torque control. The spring capsule (R) which automatically provides the 100% excess fuel for starting is attached to the fuel adjusting screw (N). This feature is only operative when the manual operating shaft is in full-speed position and engine speed is below 500 rpm. Above this speed it will not function as the governor takes control, moving the sleeve to a normal metering position.

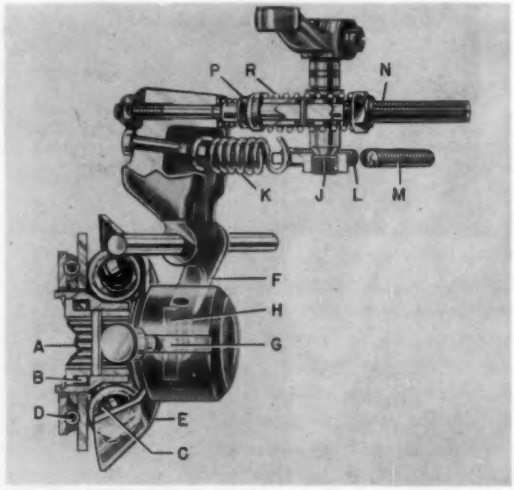


Fig. 7 Arrangement of governor and control components

A—Splined shaft
B—Shock absorber
C—Balls
D—Thrust bearing
E—Cone
F—Fulcrum lever
G—Pin
H—Pin slot
J—Manual operating shaft
K—Governor tension spring
L—Idle screw
M—High speed stop screw
N—Full load fuel screw
P—Resilient stop
R—Spring capsule

Injection Timing

It has been mentioned that injection timing could be changed independently of the amount of fuel being delivered. This is done by angular movement of the control sleeve. Where this is not required, timing is fixed by a pin engaging a slot in the sleeve to hold it stationary. By using an adjustable pin (Fig. 8), external manual adjustment through a total range of 5 cam degrees is possible.

Automatic timing as a function of manifold air speed (hence engine speed) is also possible. A small venturi in the manifold connects to a diaphragm linked to a lever and movable timing pin (See Fig. 8). Only very small pressure differences are necessary for proper functioning since the friction force of turning the lapped sleeve on the rotor shaft is all that is involved.

Fuel System and Mounting

A typical fuel system for the PDA is shown in Fig. 9. The supply pump is located in the end of the pump housing and consists of a flexible vane impeller rotating in a bore that is eccentric to the shaft axis. Fig. 10 illustrates its simplicity. It is self-regulating and reversible. The impeller is mounted directly on the injection pump drive shaft. Referring to Fig. 9, note that a small bleed line runs from the pump top back to the fuel tank. The pump is continually vented through a small check valve. This system has a beneficial effect on filter life since only the fuel actually delivered, plus a small bleed flow, must pass through the filters.

There are two basic executions of the PDA pump insofar as mountings are concerned. One is the conventional flange mounting while the other is the shank mounting similar to that used for ignition distributors.

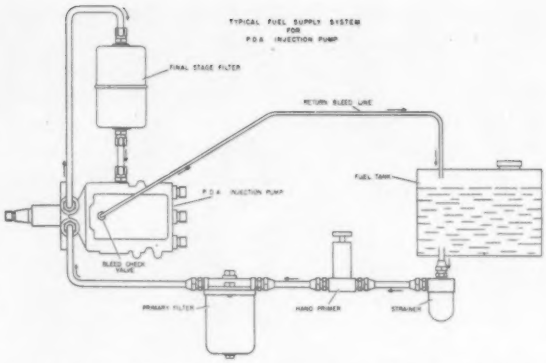


Fig. 9 Typical fuel supply system for PDA pump. Pump is continuously vented through non-return valve to top of tank through small line.

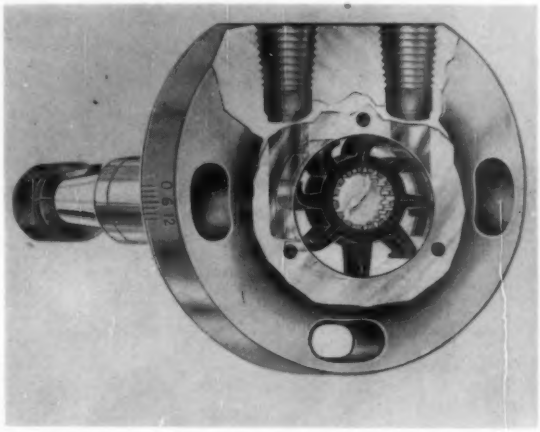


Fig. 10 Fuel supply pump is of simple and rugged construction and makes use of a flexible impeller that adds a self-regulating feature.

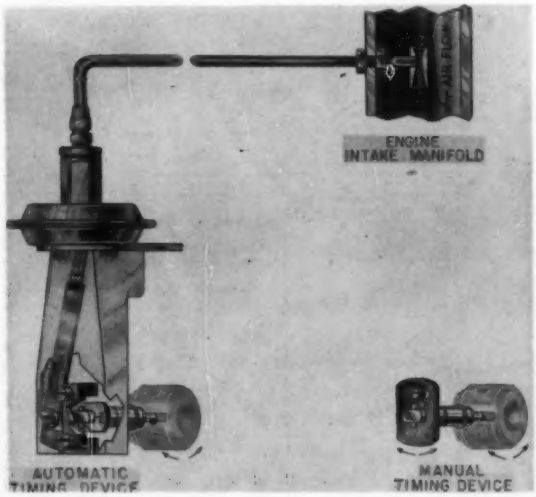


Fig. 8 Automatic and manual devices for changing timing with speed. Note in Figs. 4, 5, and 6 that angular slot location changes timing of beginning and end of injection according to load.

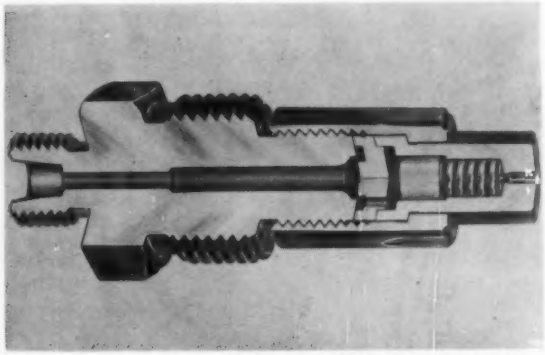


Fig. 11 Another step toward simplification of injection equipment is the ADE nozzle which is a screw-in type.

The latter type of mounting is becoming more popular since it permits the use of a common cylinder block for both diesel and gasoline versions of an engine. The pump is mounted and driven in the same manner as the ignition distributor. Also, this model can be provided with adapter flanges of any normal configuration to which it may be bolted for interchangeability with flange, base, or barrel mounting already in use.

Simplified Nozzle

The PDA will function with present nozzle types, but a simplified holder and nozzle were developed to extend its basic concept to an entire injection system. The holder and nozzle assembly (Fig. 11) screws into place. Another execution of the holder has a 90-deg bend in the fuel inlet to permit injection lines to be carried closer to the engine block.

In addition, the new nozzle Model ADE can be mounted with conventional stud hold-down of the nozzle holder. The sectional view illustrates the nozzle's simplicity. It is of the poppet type with the valve opening outwardly. No leak-off connections are required.

Performance is the Pay-Off

It is easy to reduce costs and simplify something through compromise with functionality, but it takes ideas and good engineering to do the same job with no sacrifices. American Bosch did it the hard way. To insure suitability for broad application, the PDA was evaluated on engines with various types of combustion chambers. By using engines in the range of 45 cu in displacement per cyl, some correlation was possible.

Characteristic performance of a pre-combustion chamber type, an energy cell type, and an open chamber type engine are shown in Figs. 12, 13, and 14. All curves were made with the basic PDA having fixed timing. It was found that automatic timing advance was of little value where top engine speed is 2000 rpm or less. In fact, only slight benefits were obtained in some engines rated up to 2400 rpm.

In the range above 2800 rpm, about 5% improvement in bhp and fuel economy at the high end is possible by the use of automatic injection timing advance with speed. Injection timing does have an important effect on the shape and peak position of the engine's torque curve. Changes in torque and specific fuel consumption with timing varied from 5-deg retard to 5-deg advance without any change in fuel control is shown in Fig. 15. This, of course, is true with any type of injection pump.

It can be seen that torque back-up may range from 0 to over 20% in some cases as the injection timing is varied. Any torque control feature, therefore, that is incorporated will depend to a great extent on the accuracy with which the basic timing setting is made. Fig. 16 shows the PDA's present range of built-in torque control.

Speed limitations of the PDA have not yet been determined, but with an eye to the future, testing has been at speeds well above those of existing engines. Other forward-looking features will become more important. For example, Fig. 17 demonstrates the benefits of automatic injection timing at higher engine speeds. The increased output and lower specific fuel consumption shown for a 3000-rpm engine indicate great promise for the future.

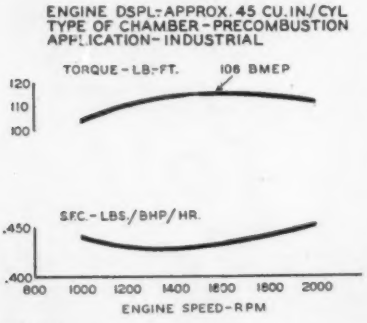


FIG. 12

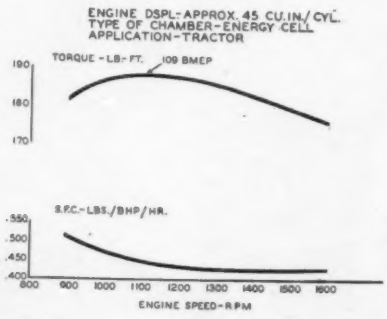


FIG. 13

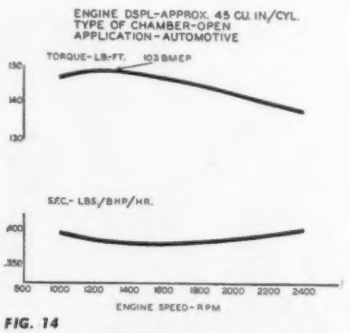


FIG. 14

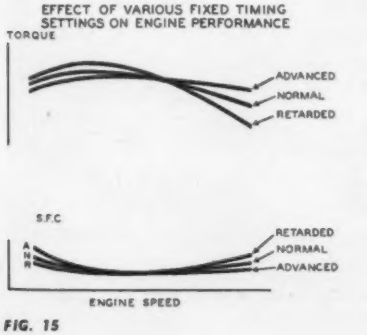


FIG. 15

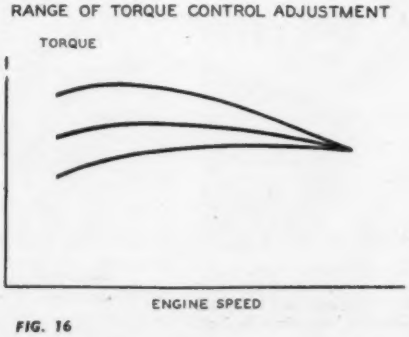


FIG. 16

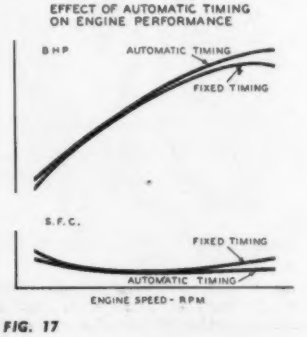


FIG. 17

B&O's "street-switcher" is a modified, Caterpillar Model DH-10 tractor powered by a 115-hp diesel.

Tractors Switch Freight Cars

B&O's answer to the problem of switching freight cars in conjested industrial areas is a tractor. It is not restrictcd to the rails and provides great flexibility.

SWITCHING freight cars in and out of industrial plants in conjested areas has been a perennial headache in many cities. First draft horses were used for street switching. These teams gave way to the electrical switching locomotive in the early 20th century, and later the diesel-electric switcher. Now tractors are being used for this important job.

A Caterpillar Model DH-10, 115-hp diesel tractor was selected by the B&O and adapted to railroad use. This unit was recently placed in street-switcher service, moving freight cars to and from many plants near the B&O's Fell Street station on the Baltimore, Md. waterfront.

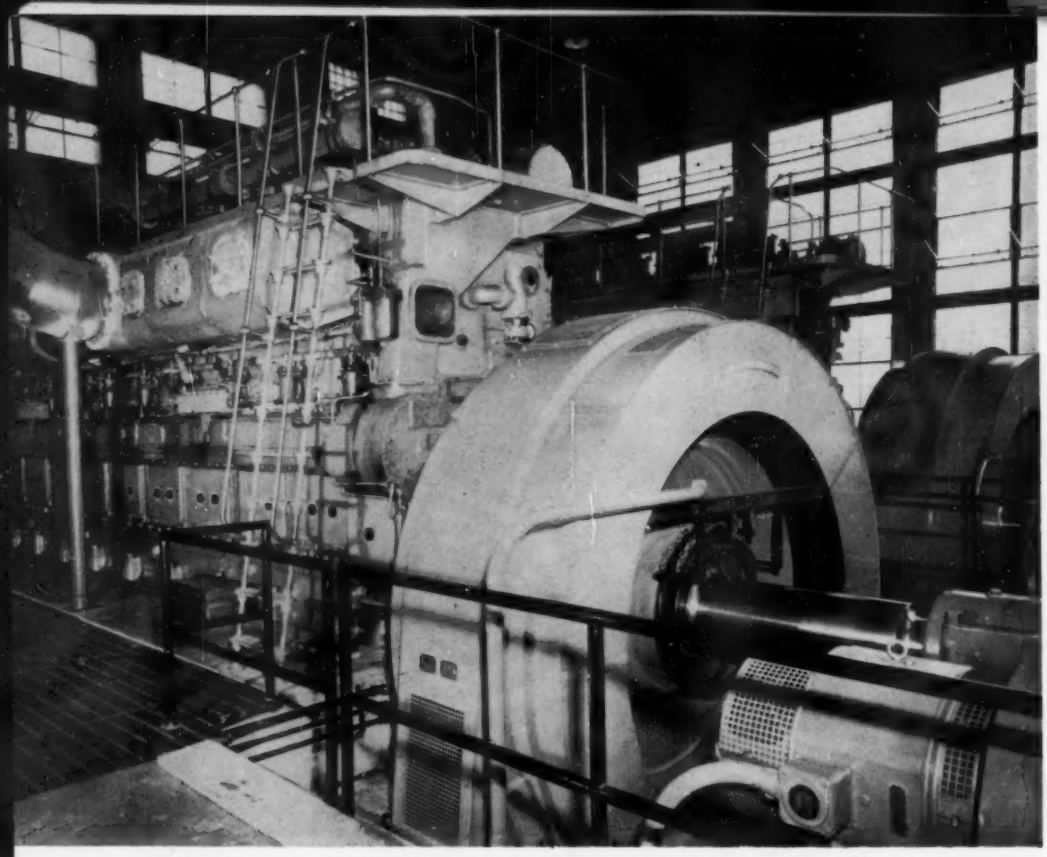
It is a 2-wheel, rear-drive, power-steered tractor, with 21-in by 25-in pneumatic tires on rear wheels and 12-in by 20-in tires on the front wheels. Total weight of the tractor, including extra equipment and some ballast over rear wheels, is 25,000 lb. Rated starting effort at drawbar is 16,000 lb, giving a capacity to haul eight loaded cars on level track.

Modification and application of special equipment was made by the Alban Tractor Co., Caterpillar distributor in the Baltimore area. A special operator's cab with suitable windows for good front and rear vision was provided. Both ends of the tractor are equipped with standard 6-in by 6-in shank couplers, push pole pockets, handholds, footboards, and marker lights. All safety appliances are applied the same as required by I.C.C. regulations.

Westinghouse special automatic air brake equipment was applied to the tractor so that air brakes on cars may be operated when desired. Train line hose on cars may be coupled to similar hose on either end of the tractor. The automatic equipment does not operate tractor brakes which are separate air brakes standard to the tractor.

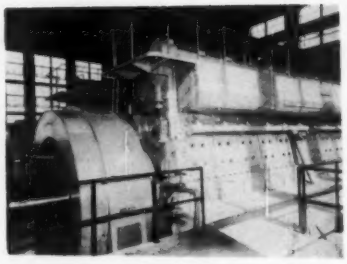
This new street switcher replaced a small trolley-operated electric locomotive which had been in service for many years at this location and has now been retired to the B&O transportation museum at Baltimore.

While the need for street switchers seems to have existed for years, there seems to be a scarcity of models from which to choose. The apparent small market probably is the reason. However, a closer look at conditions might develop more of a market than is thought possible. This market, although comparatively limited, seems to be awaiting a properly designed machine preferably assembled from standardized parts or assemblies of other machines in more popular demand suitable for railroad service.



Delivering power at the rate of 13.59 kw hr per gal, these two Model 31AD18 F-M diesels have helped Bluffton to cut fuel costs more than 18% and increase net profits 62%.

"Steam-to-Diesel" cuts costs at Bluffton



By mothballing its steam equipment and installing two more diesels, Bluffton, Indiana cut fuel costs more than 18% and increased net profits more than 62%.

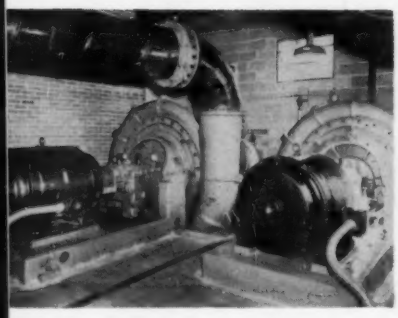
MUNICIPAL power at Bluffton has a history which goes back more than five decades to the years immediately preceding the turn of the century. In those days of steam engines and belt-driven generators, the city bought out a small private utility and moved the power house to its present location.

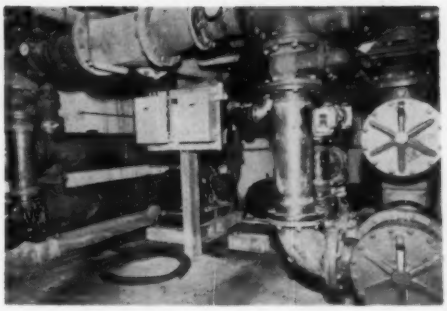
In the next 19 years, the city installed two new steam turbines, a 500-kw unit in 1917, and a 1000-kw unit in 1919. The city continued to grow. In 1928, a 1500-kw steam turbine was added in 1938, a turbine rated at 2000 kw was installed, the plant's old hand-fired boilers being converted to stoker feed and raised to 200 lb, 438°F at the same time. These improvements modernized the plant's operations and placed it on a more efficient level.

A Growing Problem

At the end of the next 10 years however, a rise in both load and total operating costs dictated an expansion of the existing facilities and the adoption of improved production methods. Influenced by the price of coal, which had risen from $6.29 a ton in 1946 to $7.80 a ton the following year, the plant installed the two 1400-hp Nordberg diesels in 1947 to help carry the peaks and to cut overall costs of operation.

The addition of the diesel engines succeeded in im-





Scavenging air is supplied by two motor-driven Roots-Connersville centrifugal blowers. They have inlet volumes of 17,700 cfm and supply air to the cylinders at 2.86 psi. Installed in the plant's basement (center), are the two jacket water heat exchangers and two lube oil coolers. Motor-driven centrifugal pumps circulate the raw water. Location of exhaust snubbers for both the Fairbanks-Morse and Nordberg engines, and a portion of the induced-draft cooling tower for the new engines, are shown in the picture at extreme right.

proving the efficiency and economy of the Bluffton plant over the next few years, but with coal prices continuing upwards to $9 a ton in 1948 and with labor and other costs reaching new highs, the plant's net profits dropped from an average of 8.7 mills per kw hr in 1946 to 2.2 mills per kw hr in 1948.

Despite the service of these units, the average fuel cost for the combined steam-diesel plant was 10.4 mills per kw hr for the year 1951. Total production costs had reached 15.3 mills per kw hr.

To bring these costs down and to increase overall plant efficiency, city engineers decided to increase diesel capacity to the point where it could carry the entire load with steam relegated to standby service. An analysis revealed however that fuel costs for a banked boiler are about 10% of costs for a boiler in full service. The same expenditure would finance the purchase of an additional diesel instantly ready for emergency use and capable of regular economical service. Steam equipment could be mothballed and could be returned to standby service whenever load growth required regular use of the standby diesel.

Faced with these facts, Bluffton decided to abandon its steam operation altogether in 1952 and turned to two 3500-hp Model 31AD18 F-M diesel engines to supply the answer to its problems.

In their first 19 months of operation, from October 1, 1952 through April 30, 1954, the 10-cyl F-M engines generated a total of 18,434,400 kw hr or more than 75% of the plant's gross total of 24,321,300 kw hr. At the same time, despite relatively poor load factors, these engines consumed only 1,356,160 gal of fuel, representing an average of 13.59 kw hr per gal. This helped raise the plant average for all four engines to 13.43 kw hr per gal. Tables I and II indicate the important extent to which the additional engines influenced Bluffton's plant economy during this 19-mo period.

New Engines & Accessories

The two Model 31AD18 Fairbanks-Morse diesels are rated 3500 hp each at 277 rpm and have a bore and stroke of 18-in and 27-in respectively. Each drives a 3410-kva, 2500-kw, 3-phase, 60-cycle, 2400/4160-v alternator, V-belted to a 30-kw exciter.

Scavenging air is supplied by individual 24-in centrifugal blowers, each driven by a 300-hp, 3550-rpm 2400/4160-v induction motor. Receiving air from either inside or outside the plant through intake snubbers and viscous-impingement type filters, the blowers have inlet volumes of 17,700 cfm and discharge pressures of 2.86 psi. A 1-kw DC-generator set is used to force the field of the alternators during starting operations.

Fuel oil of 32 grav, priced at 11.1¢ per gal delivered, is stored in two 25,000-gal above ground tanks, being fed to two 20,000-gal underground storage tanks as needed. From these tanks the fuel is drawn through large dial-type meters to a pair of 600-gal day tanks. Day tanks, equipped with individual level games and level controls, are located in the plant's basement. Fuel from the day tanks is picked up by an engine supply pump and sent through a duplex filter to the injection equipment.

Lube is circulated under pressure to all bearings and working surfaces on the engines by built-in engine-driven pumps. It is forced through a full-flow strainer in each unit and is cooled in individual shell-and-tube type lube oil coolers. Coolers are equipped with thermostatically-controlled bypass valves to help keep the lube at prescribed temperatures. Power cylinder lubrication is handled by force-feed lubricators.

The heavy-duty, high-detergent type lube oil is kept in condition at all times by a pair of 12-element, cellulose-packed filters. These receive lube from the engine sumps and return it to the sumps when it has completed its circuit. The plant has its own test kit, equipped for checking viscosity changes, water soluble precipitates, and asphaltics. In addition, samples of the oil are sent to the oil company's laboratory for periodic analysis. Each engine is equipped with a before-and-after lube pump for use in starting and shutting down operations.

Soft city water is circulated through the engine jack-

ets, cylinder heads, and exhaust manifolds by two 6-in centrifugal pumps, each driven by a 30-hp induction motor. Cooling is accomplished in individual heat exchangers equipped with thermostatic bypass valves.

Raw water is circulated through the heat exchangers and lube oil coolers by two motor-driven pumps of the same size and capacity. It is cooled in one of two induced-draft cooling towers located at the plant, the other tower serving the two 1400-hp engines.

A common gauge board, equipped with pushbutton controls for the cooling tower fans, the blower motors, the jacket and raw water pumps, and the before-and-after lube pumps, serves both engines. Also installed on this board are two multi-point exhaust pyrometers, alarms on lube and jacket water pressures and temperatures, and a complete set of gauges on lube pressure and temperature, jacket water pressure and temperature, raw water pressure, and scavenging air pressure.

The gauge panels and most auxiliaries serving the four engines in the plant are installed in a shallow, 9-ft deep basement. A compromise between a trench system and a full basement, it has plenty of working room and yet was constructed at a cost which was no more than that of a standard trench.

In fact, roominess is one of the principal features of this modern power house. No additional construction was necessary when the two F-M engines were installed and there is plenty of space to dismantle each engine without crowding. The only acoustical material used throughout the building is cinder block and results have been highly satisfactory to date.

Summing Up

In operating the Fairbanks-Morse engines, Harley Mosure, chief engineer, tries to balance them as much as possible rather than using one as a base-load engine and the other as a standby. By running one for a week and then switching to the other, he can be sure that both are in top condition and ready for service. A normal 24-hr schedule runs like this: from midnight to 5 am, the two small engines (total capacity 2000 kw); from 5 am to 7 am, one 2500-kw F-M; from 7 am to 9 pm, one 3500-hp and one 1400-hp (3500-kw capacity); and from 9 pm to midnight, one 2500-kw F-M. The 1400-hp diesels generally carry the light Sunday load. It will be seen from Table II that the big engines carried 76% of the load in 1953.

Immediate responsibility for the success of the Bluffton plant lies with Ben H. Freeland, city engineer and superintendent of utilities. Ultimate responsibility, of course, rests with Mayor J. H. Robbins and with the city council.

It was this group of men which decided on the conversion of the municipal plant from steam to diesel power and on the installation of the two F-M diesels. The considerable savings which have resulted and are being returned each year to the city treasury and to the citizens of Bluffton can be attributed directly to their initiative, planning, and foresight.

Table I

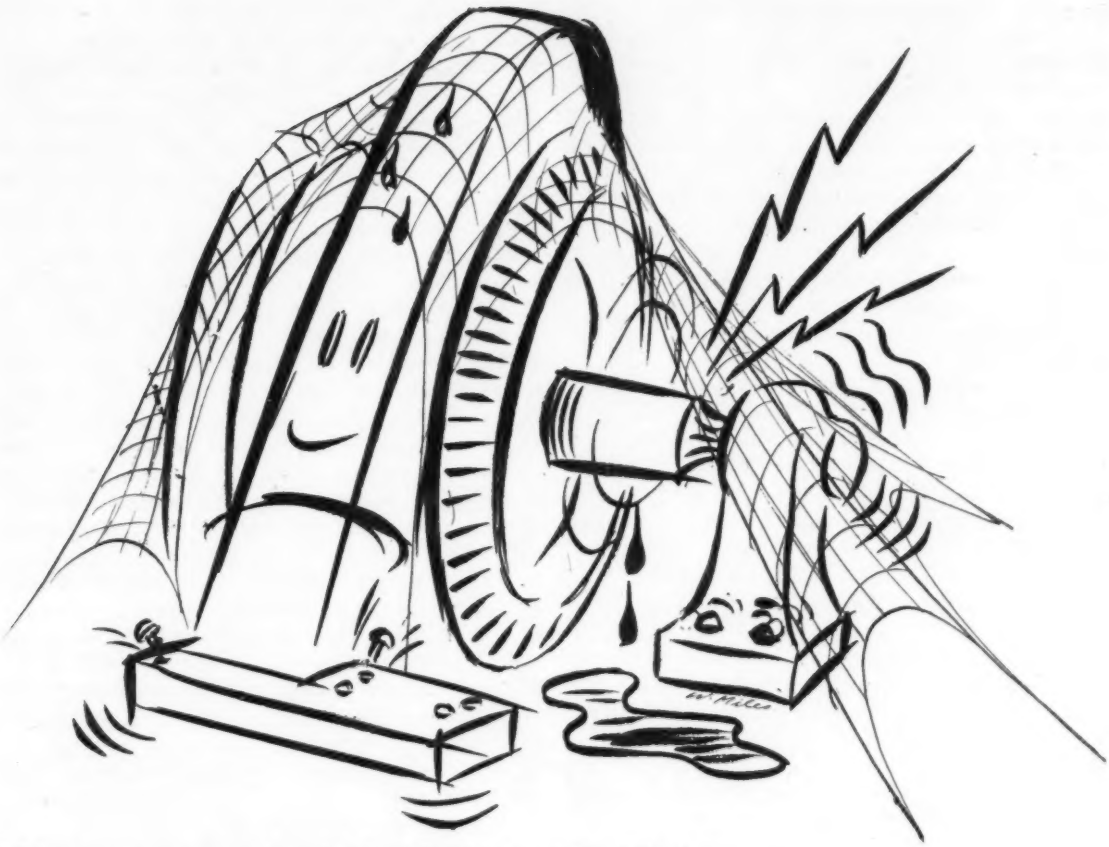
	1952	1953
Gross Kw Hr Generated	12,699,750	15,105,400
Kw Hr Steam	5,046,250	—
Kr Hr—1400-hp diesels	5,326,100	3,614,400
Kr Hr—3500-hp diesels	2,327,400	11,491,000
Plant Fuel Costs—Mills/Kw Hr	10.1	8.2
Production Cost—Mills/Kw Hr	15.1	11.9
Net Profit—Mills/Kw Hr	2.9	4.0
Net Profit—Total	$37,297.90	$60,696.95

Table II

	Kw Hr Generated		Gas Fuel		Kw Hr/Gal	
		Total		Total		Total
Month	F-M	Diesel	F-M	Diesel	F-M	Diesel
Oct. '52	766,400	1,207,600	55,270	88,400	13.86	13.66
Nov.	679,600	1,210,600	49,155	88,875	13.82	13.62
Dec.	881,400	1,391,700	63,933	102,343	13.78	13.59
Jan. '53	1,147,000	1,396,800	83,318	102,138	13.76	13.67
Feb.	1,061,500	1,241,400	77,177	90,897	13.75	13.65
Mar.	1,128,500	1,317,600	81,551	95,651	13.83	13.77
Apr.	1,042,000	1,253,700	75,118	90,898	13.87	13.79
May	939,000	1,181,900	69,109	87,509	13.58	13.50
June	963,000	1,159,300	72,204	87,304	13.33	13.27
July	739,000	1,148,000	56,214	88,334	13.14	12.99
Aug.	718,000	1,176,000	54,808	90,878	13.10	12.94
Sept.	820,000	1,232,000	60,238	92,338	13.61	13.34
Oct.	863,000	1,269,100	61,939	94,109	13.93	13.48
Nov.	903,000	1,276,400	65,720	94,910	13.74	13.45
Dec.	1,167,000	1,453,200	85,316	107,626	13.67	13.50
Jan. 54	1,176,000	1,424,700	87,355	106,795	13.46	13.34
Feb.	1,052,000	1,275,400	78,140	95,830	13.46	13.30
Mar.	1,263,000	1,425,600	94,205	106,915	13.41	13.33
Apr.	1,125,000	1,280,300	85,390	98,100	13.15	13.05
Totals	18,434,400	24,321,300	1,356,180	1,809,850	13.59 (av.)	13.43 (av.)

Principal Equipment—F-M Engines

Engines	Fairbanks, Morse & Co.
Generators	Fairbanks, Morse & Co.
Governors	Woodward Governor Co.
Scavenging air blowers	Roots-Connersville Blower Corp.
Blower motors	Fairbanks, Morse & Co.
Air filters	Air-Maze Corp.
Air intake snubbers	Burgess-Manning Co.
Exhaust snubbers	Burgess-Manning Co.
Fuel System	
Oil	Shell Oil Co.
Meters	Buffalo Meter Co.
Filters	Wm. W. Nugent & Co., Inc.
Lube System	
Day tank level gauges and controls	Rochester Mfg. Co., Inc.
Oil	Shell Oil Co.
Filters	Fairbanks, Morse & Co.
Cylinder lubricators	Madison-Kipp Corp.
Coolers	Kewanee-Ross Corp.
Bypass valves	Powers Regulator Co.
Before-and-after pumps	George D. Roper Corp.
Cooling System	
Cooling tower	J. F. Pritchard & Co.
Heat exchangers	Kewanee-Ross Corp.
Pumps and motors	Fairbanks, Morse & Co.
Jacket water bypass valves	Powers Regulator Co.
Gauge panel	Electric Service Engineering Co.
Pyrometers	Illinois Testing Laboratories, Inc.
Gauges	Marshalltown Mfg. Co.
Switchboard	Westinghouse Electric Corp.



To keep your generator from looking like this, read the following . . . .

Questions and Answers on Electrical Equipment

DIESEL Men have their electrical problems too. This was evidenced by the interest of some 95 persons, ihe bulk of them diesel power plant engineers, who attended a recent over-the-breakfast-table discussion where electrical equipment maintenance was the subject.

The occasion was a breakfast session, sponsored by the Diesel Engine Manufacturers' Association, for this special group who was attending the Annual Conference and Exhibit of the Oil and Gas Power Division, American Society of Mechanical Engineers.

Discussing the subject were two speakers: Mr. A. L. McNary, Supervising Engineer Synchronous Machines, Fairbanks, Morse and Company; and Mr. Oscarson, Application Engineer, Electric Machinery Manufacturing Company. The session has been summarized in question and answer form because it is felt that the subject matter has broad interest. It may contain the solution to some of your electrical problems.

Mr. McNary

Q. What are some of the requirements of a preventive maintenance program?

A. 1. Schedule shut-down time of machines so that the electrical equipment can be inspected at the same time other equipment is being checked.

2. Build up and maintain a reserve of parts for the units so that quick changes can be made.

3. Keep spare parts clean, dry, and in good order for quick installation.

4. Keep records of troubles and cures as a means of running down chronic cases and finding the causes.

5. Carry out inspection regularly and thoroughly.

Q. What should be done to the equipment in order to secure long life?

A. 1. Keep it clean.

2. Keep it properly lubricated.

3. Keep a regular inspection schedule.

4. Don't wait for motors to squeak for lack of lubrication or smoke from overload before checking their condition.

5. Know the condition of the equipment.

6. Know what loads the equipment must carry.

7. Correct any indication of weak points before the equipment fails.

Q. When inspecting the surroundings of a motor or generator, what must be checked?

A. Check the surrounding atmosphere for drippings, fumes, dust, chips, or lint which might possibly get into the machine and cause trouble.

Q. How often should a machine's surroundings be checked?

A. This inspection should be made weekly.

Q. In regard to lubrication, what should be checked?

A. Make sure the proper oil level is maintained. On some machines it is necessary to check the oil level with the machine shut down, otherwise a correct reading is not obtained. Check also for any excessive leakage of lubricant.

Q. What should be checked regarding the general mechanical condition of the machine?

A. Check for any unusual noise or odor which would indicate impending trouble.

Q. What should an inspection of the bearings consist of?

A. Check for excessive noise and vibration as well as the temperature of the bearing. On some grease-lubricated ball bearing machines, excessive heat in the bearings may be caused by too much grease in the housing.

Q. What should be looked for when checking brushes and commutators?

A. Check for sparking at the brushes. Note the color and surface of the commutator. Improper spacing of the brushes may cause grooving of the commutator. Excessive sparking might be caused by a high commutator bar. Check the mica between segments and make sure it is properly undercut.

Check the brushes for wear and contact surface. Examine pigtail connections for looseness. Make sure brushes are the proper fit in the brushholder, are free to move, and have the correct pressure for the size of the brush.

Q. Should the windings of a machine be checked and cleaned periodically?

A. Yes, this should be done regularly. The windings should be cleaned by suction or mild blowing. Do not use excessive pressure as this might imbed foreign material in the insulation.

Wipe off the dust with a dry cloth.

Examine the coils for any indication of oil or grease which may have worked its way to the windings.

Windings may be cleaned with carbon tetrachloride in a well ventilated room. The insulation resistance should be taken periodically and recorded as a possible indicator of impending trouble and be sure and record the temperature of the winding at the time the readings are taken, otherwise the readings have practically no value.

If the surface of the insulation has become dry and cracked, it should be given a coat of air-drying insulating varnish.

Q. What might a severe vibration in the stator of an alternator indicate?

A. This is usually an indication of some of the field coils having some of the turns short circuited, thereby causing an unbalance in the magnetic circuit of the machine.

Q. How can the generator field coils be checked for shorted turns?

A. Apply a DC voltage to the winding and check the voltage drop across each coil. Voltage drops should check within 5%.

Q. Is it necessary to replace one or two stator coils in a generator in case of their failure?

A. Ordinarily, no. The coils can be cut out of the circuit and operation continued. The coils could then be replaced during some regular overhaul period or at such time as the condition of the machine would warrant the replacement of the coils.

Q. What might excessive field current on an alternator indicate?

A. 1. Short turns in the field coils.

2. Operating the machine above its normal voltage rating.

3. Operating on a low power factor load.

4. An overload.

Q. What instruments are needed for a maintenance program?

A. Portable indicating voltmeter, portable ammeter, megger, thermostats—centigrade type 0°C to 100°C, and spring balance.

Mr. Oscarson

Q. What causes shaft currents in diesel engine generator sets?

A. Shaft currents are caused by magnetic dissymmetry in the generator stator. This may result from the nature of the joints when the magnetic laminations come together, or it may originate in the iron itself due to difference in characteristics with the grain and across the grain of the laminations.

Q. How can I tell if shaft currents are present?

A. If damaging shaft currents are present, the outboard generator bearing and possibly the engine main bearings will usually run hot and there will be dark mottled spots similar to rust spots on the bearing surface.

Q. How can they be eliminated?

A. In an engine-type generator with outboard bearing, it is usually sufficient to insulate the pedestal from the

sole plate by means of ⅛-in micarta; the hold down bolts and dowels must also be insulated by means of bushings and washers. Care must be taken not to short circuit the insulation by oil lines, conduit, etc.

Q. Will shaft currents originate in the exciters?

A. Exciters usually cause no significant shaft currents.

Q. Should a generator be dried out before putting in operation the first time, or after a long shut down?

A. Unless damp conditions prevail, drying out should not be necessary. If there is any question on the insulation, resistance should be checked with a megger. A satisfactory minimum value of stator insulation is one megohm per 1000 rated volts. (2.4 megohms for 2400 volts, etc.) Stator insulation resistance should be about 75 megohms. These values are at 25°C or 78°F and should be more at lower temperatures.

Q. How should a generator be dried out?

A. Short circuit the generator terminals through a current transformer. Drive at normal speed and apply enough excitation to permit full load stator current to flow. If the engine cannot be run, current can be circulated from a welder. Do not permit coil temperature to exceed 80°C. Check insulation resistance at 6-hour intervals with a megger. Resistance may actually drop during the first 6-hour period due to stator temperature increase but should come up after that.

Q. Is it safe to operate at normal voltage and load when insulation resistance reaches 1 megohm per 1000 volt rating?

A. Ordinarily, yes. However if stator has been flooded or has been excessively dirty, it should be thoroughly cleaned with a nontoxic solvent before drying. After a value of 1 megohm per 1000 volts is reached, a high potential test should be applied. On a new machine the applied voltage between stator winding and ground should be twice rated voltage plus 1000; on older machines the test voltage should be 2/3 of that for a new machine.

Q. How can I tell if any stator coils are short circuited?

A. If the generator is operated at full speed with approximately half of full load excitation applied, a short circuited coil will show itself immediately by the characteristic odor of scorched insulation. If operation is continued, the coil will smoke.

Q. Is it safe to operate with a short circuited coil?

A. The coil should be replaced. For emergency operation, it is satisfactory to disconnect the coil from the adjacent coils, short circuit around it, and then saw the coil in two so no current can flow through it.

Q. What is the proper brush tension and current density in my exciter?

A. The brush pressure should be about 2½ psi. Current density should be not less than 35 amps per sq in and usually not over 55 amps per sq in. If current density is less than 35 amps per sq in, remove some of the brushes, staggering them so uniform commutator wear is obtained.

Q. What grade brush should be used?

A. Usually the one supplied by the manufacturer. However, sometimes a change should be made. After a short period of operation, a copper oxide coating, uniform glossy chocolate color in appearance, should form. Do not remove this. High humidity may result in too thick an oxide coat and then a more abrasive brush should be used. When it is extremely dry, a relatively soft brush should be used. When there is a decided difference between winter and summer humidity, it may be necessary to change brushes twice a year for best operation.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 69 to check them.

1. In applying corrugated metal hose in an application where movement is expected, a safe rule-of-thumb is to allow one foot of hose for
   a. each ¼-in of movement
   b. each ½-in of movement
   c. each ¾-in of movement

2. Flexible metal hoses should not be expected to do any more than support their own weight.
   a. True b. False

3. Centrifuge bowl cleaning becomes more of a problem when dealing with heavy fuels because of
   a. their relatively high viscosity
   b. their high degree of contamination
   c. their low specific gravity

4. The piston ring carriers shrunk on and welded to Alco locomotive engine pistons also serve to
   a. control expansion
   b. enclose the oil-cooling grooves
   c. strengthen the piston

5. Presence of shaft currents in engine-driven generators may cause an outboard bearing to run hot and cause the bearings to have dark mottled spots similar to rust spots. What would you do to correct this?
   a. Clean up bearing and use transformer oil.
   b. Replace bearing with one of different metal.
   c. Insulate pedestal and its piping, bolting, etc.

6. A satisfactory minimum value for generator stator insulation is considered to be
   a. one megohm per 1000 rated volts.
   b. one megohm per 1500 rated volts.
   c. one megohm per 2000 rated volts.

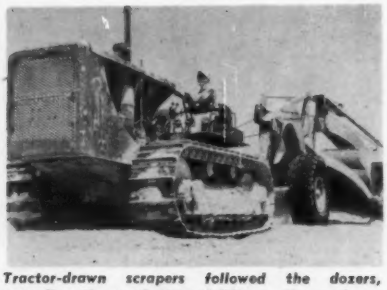
7. Dry-type air filters can be very efficient, taking out even very fine particles of micronic size, but their resistance to flow must be high in this case.
   a. True b. False

8. Ability to alter fuel injection timing with engine speed has shown a marked improvement in performance and also specific fuel consumption in engines of all speeds.
   a. True b. False

Initial work on the road was done with teams of bulldozers. Dust and heat make the job a tough one, both on the men and the equipment.

Building a Desert Road

Saudi Arabia or the Mojave Desert, the mountains of Turkey or the Rockies—road building principles are essentially the same. Conditions may differ but it is always a tough job where diesels excel.



Tractor-drawn scrapers followed the dozers, spreading the crushed marl lifts on the roadway.

Crushed marl was also used to strengthen the blacktop. Dozer and clamshell, behind crusher, load pugmills.

FROM preliminary cut-and-fill operations to final rolling of the wear course, road building is tough work requiring tough machines. That's why you see so many diesels in this type of operation. In site preparation, borrow pit operation, crushing and screening of aggregates, asphalt plant operation, transportation, spreading, grading, ditching, compacting, paving and finishing, ability to "take it" is important. A lot of jobs can't be stopped once they are started.

When you decide to build a road in Saudi Arabia, you find that sand, wind, and sun are no mean antagonists. Pitting diesel-engined bulldozers and earthmoving equipment against sand dunes which range from 20 to 30 ft in height is an example of man's determination to lick the elements. His judgment is tempered by his faith in his modern machines. This is typical of so many accomplishments of the Saudi Arabian oil operation.

A new road, 24-mi long, is scheduled for completion during the first part of 1955. It will make automobile travel more comfortable and faster between Abqaiq and Dhahran, desert communities of the Arabian American Oil Company. But before this road could become a reali-

ty, the stern aspects of the sand country had to be considered. Design for the required wheel loads and traffic density, featuring construction using local materials to the fullest degree, had to be worked out.

This was done and construction started last June. The road had to be built high on the dunes because up there the higher wind velocity would blow sand across the road rather than drift it on the surface. The cut-and-fill operation consisted of resituating the dunes, end to end wherever possible, to form a long, continuous causeway for the road bed. Bulldozers, three abreast, started leveling out the right-of-way.

A hundred pieces of equipment, including 50 Caterpillar tractors, shoved the desert into the shape of a road. Engineers estimated that 1,500,000 cu yd of sand had to be moved to form the base of the roadway which was to be 24-ft wide with 4-ft shoulders.

While the sand was used for the road embankment, the material to be used for the sub-courses and topping was another matter. The construction men used a material native to eastern Saudi Arabia. This was marl, a lime and gypsum deposit resembling a white-grey crumbly rock. This was under the sand and some was uncovered in the fill operations. However, the marl averaged only 18-in in depth with rock underneath. This meant the chore of borrowing over a wide area and from points as far as 7000 ft from the right-of-way.

Once excavated, the marl was hauled to a central spot where it was run through a crusher. The screened material became the base courses. The design called for 15 inches of the material in two separate lifts. Each course was spread and compacted. Water was added to get the optimum consistency for compaction. This job was done by using sheepsfoot rollers.

The asphaltic concrete used for topping was mixed and spread on the prepared base. Fines from the marl-crushing operation were used with the asphaltic materials to improve the wearing qualities. A 3-in topping was used, rolled to a smooth riding surface.

In this particular road building job, drainage was no problem. In fact, getting water for compaction was difficult. Up to the 10-mi mark, it was comparatively easy to get by tapping right into nearby water lines. But as the right-of-way out-distanced these pipes, 3500-gal tank trucks had to be used for daily water hauling.

Despite the water shortage, culverts had to be constructed. They were not for water but for oil pipelines to cross under the roads. Reinforced concrete construction was used. The 76-ft culverts were built near the Abqaiq end of the road.

The road was built for the same reason that there is a huge roadbuilding program started here—to relieve traffic congestion. Desert traffic has grown to such an extent that an improved highway was needed to relieve traffic in and around industrial areas of Aramco's operations between the two communities. It seems that not only do we export the diesel machines to do these jobs, but also the conditions that make their use necessary.

As the road lengthened, large tank trucks were needed each day to supply water for the compaction of marl lifts.

Sheepsfoot rollers, drawn behind crawler tractors follow the tank trucks. At this point compaction is nearly complete.

Near Abqaiq concrete culverts were installed where pipelines and road cross. Arabian American Oil Company installations in background.

Blacktopping is the final step. It is a 3-in layer of asphalt paving, strengthened with marl, that when rolled will make riding comfortable.

Dry-type air filter installed on bulldozer working in bauxite-laden atmosphere of ship's hold. Note vacuum gauge for checking air flow.

Dry-Type Air Filter Proves Effective

Simple, compact units feature micronic filtration along with self-cleaning features.

Component parts include micronic dry-type element (convoluted element covered by mesh), cover flange, element support cup with gasket, and clamping ring.

LATEST entry into the battle against air-borne dirt is Purolator Products' new dry-type cleaner. It has been under laboratory and actual field test for several years and was recently introduced on a commercial basis. Purolator felt that if there was any justification for micronic filtration of the lubricating oil, it was equally important to keep the same-size materials out of the engine's top end.

So the emphasis during research was to stop particles down to one micron (0.00004-in) size from getting through the cleaner. The 0- to 5-micron size particles have always been the tough ones to remove from the air stream, particularly when agglomerations containing a lot of these fines were broken up by pre-cleaner action. The search was on for a suitable media to catch these extremely small particles.

The material eventually selected was a special resin-impregnated cellulose. As treated, it resists moisture, acids, oils, and exhaust gases. Dense enough to catch the micronic particles, it is still quite pervious to air flow. Overall restriction of the filter is a matter of surface area. Adequate area is needed not only to control flow restriction but to keep influent velocities low to maintain a high degree of filtration and for ease of self-cleaning.

Getting a lot of surface area in a compact unit is the same problem that Purolator faced with their oil filters. The solution for the air filter was the same—convolutions. By forming a convoluted cylinder of the cellulose in the housing, the smallest unit, the AF-100, gives 3161 sq in of filtering surface. Multiple units are used for the higher air quantities to get optimum flow velocity through the media and low pressure drop. Or the larger AF-400 cowl-mounted unit could be used.

The net result is a dry-type element with high filtering efficiency, especially in the small particle range, low restriction, small size, and low weight. The unit is very simple and this simplicity extends to servicing as well. Elements are replaced in a very short time.

On the other hand, they last a long time. One advantage of this surface type of cleaning is that particles have little chance of sticking. Some cake may build up (incidentally increasing the filtering efficiency), but it will fall by its own weight aided by normal engine vibration. Thus, the unit is substantially self-cleaning.

These units are pretty new in the field, but some operating experience shows great promise. Services include bulldozer operation in bauxite handling, heavy truck service in open-pit metal mining, state highway vehicles in both on- and off-highway applications, and others. Decreased operating and maintenance costs are reported. Service records of one truck operator show substantial cost reduction in air cleaner servicing alone.

Among the newest users is the Cummins Diesel Engine Company. They have approved it for single and double mounting on their engines designed for truck, tractor, and stationary service. Also, several large truck manufacturers are reported to be incorporating these new filters in their new lines.

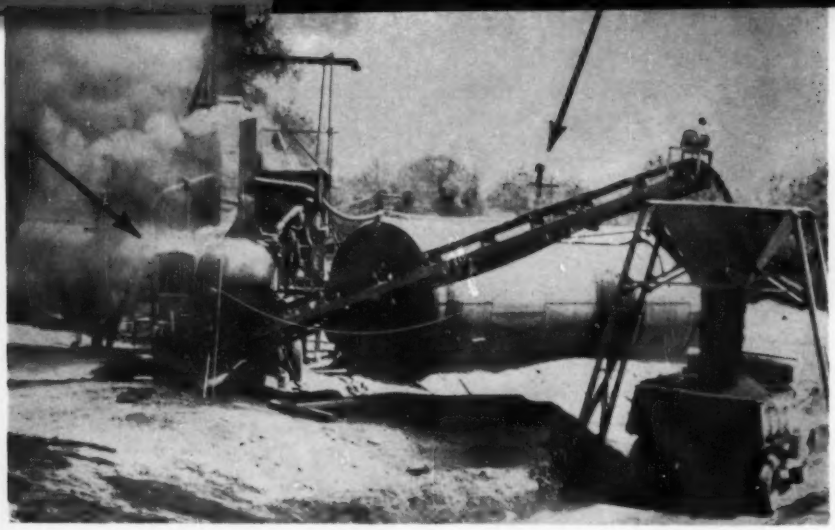
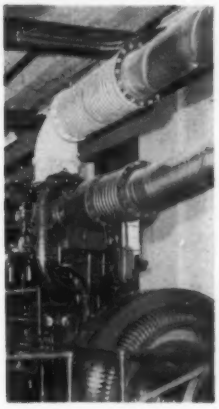


Photo courtesy Detroit Diesel Engine Division, GM

Flexible metal hose was used between the arrows to place air intake away from smoke and dust.

Here, flexible metal hose provides for both expansion and vibration isolation. Note that bends are made in solid portion of lines, allowing for straight-line installation of flexible hose.



Selecting and Applying Flexible Metal Hose

by H. L. Rubin, Atlantic Metal Hose Company

Picking the right metal hose for the job is half the battle. The other half is installing it properly. Here are some ideas for licking both parts of the problem. The payoff is trouble-free operation and long life.

"PLEASE ship me a 4-ft length of 6-in diameter flexible exhaust hose." This request is typical of 98% of the orders that we receive based on quotations. Application information is totally lacking. The remaining percentage supplies only about 10% of the details that are normally considered when engineering installations.

We ship the hose; that's our business. But we can't help wondering whether the user is getting the best hose for his job and the most for his money. Like all manufacturers, we take pride in our products and want them to do the best job of which they are capable. This way we never know. However we feel that the black eyes that metal hose gets from time to time are not so much due to product failure as to improper selection and/or application.

We do know that among our most successful installations are those where we had the chance to sit down with the user and combine his knowledge of the application with our specialized knowledge of metal hose. Our experience goes back to 1914 when my father started with this business. Since then, we have faced just about every metal hose problem in practically every basic industry. In our recent four-fold expansion of facilities, we are expanding not only production but the amount of research conducted.

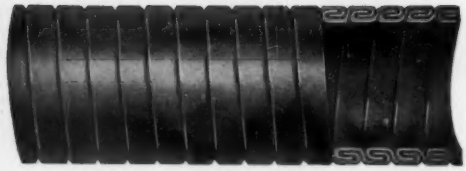
One thing that we found out long ago is that in the metal hose business, the special job is practically standard operation. The variation in requirements stresses the importance of the user knowing something of the fundamentals of metal hoses and its application, if only for the purposes of preliminary thinking. It also explains why the smart user seeks the guidance of the application engineering service offered by the metal hose manufacturer.

In any case, give your supplier an opportunity to help you by giving him all the application data possible. Then he can supply what you ask for, or call your attention to the unsuitability of your choice and make an alternate recommendation. Here is a rundown on some of the things that should be known.

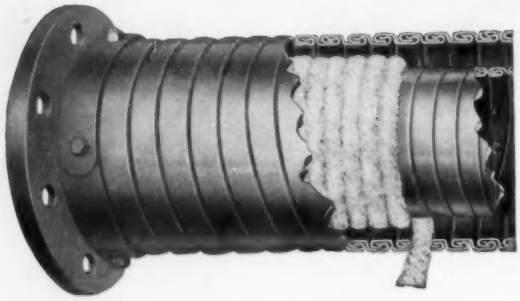
Application Data

Size—Most frequently, hose diameter is determined by the size of connecting piping, flanges, or fittings on connected equipment.

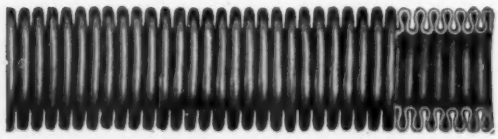
Length—Overall length including fittings (face-to-face) should be given. Length determination must include allowance for bends. Be sure that the bends are not sharper than the minimum allowable radius for the hose type selected.



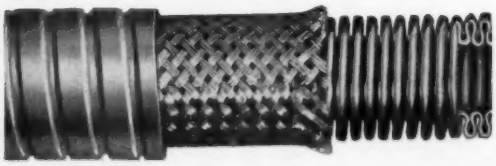
An example of high-pressure, strip-wound metal hose. The flattened "S" shape provides quadruple wall thickness. Overlaps are sealed by packing. For unusually high pressures, braid is added and wire armor.



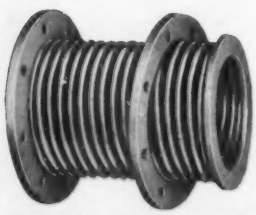
Air-jacketed hose for diesel exhaust lines employs strip-wound construction, asbestos lagging, and larger strip-wound outer hose. This type permits minimum heat radiation while still retaining flexibility.



Corrugated seamless tubings, resembling bellows, combine high-pressure capability with flexibility. Bellows design is particularly suitable where vibration isolation, offset connections and flexibility enter the picture.



For higher pressures, wire braid is usually added to the corrugated tubing. This restrains the natural tendancy of the tubing to elongate. Strip-wound armor is added where severe pressure and abrasion prevail.



Corregated diesel exhaust hose, in straight or bent sections, isolates vibration and provides for expansion and contraction. Usually one fixed and one floating flange are provided for twist-free alignment.

Fittings—The type of fittings required should be specified. When flanges are specified, data should include whether they are American Standard or special. In the latter case, all dimensions should be given. When nipples or other threaded fittings are wanted, all the pertinent data—type, male or female, thread size, etc.—should be spelled out.

This data will at least give you something of the proper diameter that will fit. More information is needed to insure that the proper hose type and material is selected and that the proposed installation is the best to obtain satisfactory operation and long life. Answers to the following questions will help.

Media Handled—What's going through the hose? Is it air, water, lube oil, or exhaust gas? This factor can influence the type of hose selected and the material to be used.

Working Pressures—Hose designs, material used, and its thickness are factors in determining allowable working pressures. It is uneconomic to use a high-pressure hose in a low-pressure application. By the same token, trying to get by with a hose working at or beyond its design pressure limitations can be troublesome and costly.

Temperatures Encountered—Where high temperatures are expected, suitable designs and materials must be used or trouble can be expected. Less expensive types may be entirely suitable for low-temperature operation.

Installation Requirements—The degree and type of movement is important. What is the amount of relative movement of the two connected pieces? Is movement due to thermal expansion or contraction, vibration, or are the two pieces designed to move in relationship to each other. It is helpful to know the nature of any offsets involved.

Piping Layout—A good layout with plan and elevation views will improve visualization. An experienced metal hose engineer can then take all the data into consideration, get a picture of the planned installation, and come up with a sound recommendation.

Our engineer friend has an advantage over the average user; he is intimately familiar with the types and characteristics of the metal hose that is commercially available. He can often put his finger on one that will do the job best, both functionally and economically. So if hose selection is being made in the field, even in a preliminary way, this information is valuable too.

Types of Flexible Metal Hose

There are two basic types of flexible metal hose—a strip-wound and the tubular corrugated type. Each has its own uses. Both types may be strengthened by braided wire coverings and protected by armoring.

Strip-Wound Metal Hose is made by spirally winding a metal strip around a mandrel to maintain the desired ID of the hose. In the winding process the strip is formed into a flattened "S" shape with all the edges interlocking. In this way a continuous hose is formed. Some slight

movement can occur at the interlocking joints and it is the accumulation of this movement over a length of hose which provides flexibility. The limits of movement also controls the allowable bending radius.

Various types of "packing" can be rolled into the joints to improve sealing. Different metal wires and asbestos are typical packings. Common strip materials are bronze and galvanized or plain steel. Aluminum, brass, and stainless steel are used in some special applications.

The materials, shape of the interlocking portions, and the type of packing, determine the pressures that the hose will stand. A 1-in hose of bronze or steel, designed for high pressures, will withstand a 500-psi hydrostatic test when straight and 400 psi when bent. These limits can be extended by the use of braid. This same hose has a minimum inside bending radius of 16-in.

Lighter materials and different interlocking design will produce hoses perfectly satisfactory for lower service requirements and at lower cost. Special types are also made with certain applications in mind. For example, we make a special diesel exhaust hose that is air-jacketed. An inner strip-wound hose is wrapped with asbestos and is concentrically located inside a larger hose, also strip-wound. The asbestos and the air space are effective insulators.

Tubular Corrugated Hose is formed from a single piece of solid drawn metal tubing. Being of one-piece construction, it needs no packing, is absolutely tight, strong, and quite flexible. Each firm making this hose has its own method of forming the corrugations and we are no exception. In developing our method we worked until we could get uniformity of wall thickness and deep corrugations to improve flexibility.

In the smaller sizes, say up to 3-in ID, this type of hose is commonly made in a number of materials—bronze, Monel, steels, and stainless steels. When it comes to diesel exhaust hose, the metal is usually steel and sizes run up to 36-in ID. The "bellows" action absorbs vibration and, providing the length of the hose is sufficient, makes a good expansion joint in the high-temperature exhaust lines.

Ability to stand high pressure is not a major requirement in exhaust and intake line applications. However, some of the smaller sizes used in hydraulic systems must withstand high pressures. Taking the 1-in size used in the case of the strip-wound hose, the corrugated type has a test pressure of 2000 psi with one braid, 4000 psi with two braids, and 5500 psi with three. Braids overcome the natural tendency of these hoses to elongate under pressure and increases their strength without sacrifice in flexibility. The minimum bending radius in this case is 11-in.

This gives a general idea of the various types of hoses available. Obviously, the specialist with his detailed knowledge still has the edge in making the best selection and should be consulted. However, selection is one major problem; another is application and it can be equally important. The best product can be ruined in short order if not applied in accordance with design limitations.

Applicational Do's and Don't's

Some hoses are bought in lengths to be cut and fittings attached in the field. Sometimes this works out fine, but as a generalization, fittings should be factory-installed. The reason is simple; it is a specialized job. Wall thickness of the hose is thin in relation to the fittings and it requires a lot of skill to weld the two together without burning the thin metal. Hose ends, particularly with the corrugated type, must be properly terminated before attachment of fittings so as to get a strong leak-proof joint. Braids are always tricky to handle.

Be careful where offsets are concerned. Allow sufficient hose length to do the job right. Lay out the piping so as to keep all bends in the same plane and space things out in order to keep the radii of the bends well within recommended limits. Provide a straight hose section after the fitting and before a bend so that the bending strains are not placed on the joint.

Twisting should always be avoided. When threaded fittings and couplings are used, wrench force should never be allowed to put any twisting strains on the hose. If flange fittings are used, one should always be of the "floating flange" type to permit alignment of bolt holes without any twisting.

When hose is used as an expansion joint, length is again a factor. Failure to provide adequate length can lead to hose or pipe breakage. A good "rule-of-thumb" is to use a foot of hose for each ¼-in of expected movement. Another important point, particularly where corrugated hose is used in exhaust piping, is that freedom of movement must not be restricted, as for example, by the application of lagging in the corrugations. In such cases, the hose should be first covered by mesh or screening.

Hoses should never be expected to support more than their own weight. You can't even expect this of long sections; they require supplementary support. No method of attachment should be used where the weight of the hose or anything attached tends to increase the angle of bend.

Summary

Flexible metal hose is available in enough types, materials, and sizes to meet practically all application requirements. The success of an installation will depend upon the soundness of selection and the observance of simple precautions made necessary by the characteristics of the hoses.

The best way to insure a successful job is to cooperate with the metal hose manufacturer by giving him as much data as possible concerning the application. Then you can gain the benefit of his experience and his specialized knowledge to get the proper hose for the job and install it correctly. Functionally and economically this makes good sense.

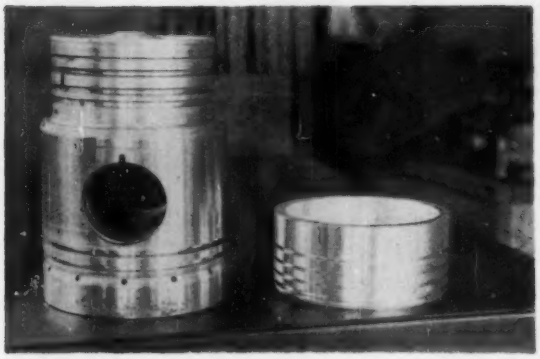
Developed by the National Electric Coil Company and built by Sayre Shop personnel, this traction motor frame positioner holds frame in desired position while field coils are being removed, installed, or tested.

Repairing Diesels on the Lehigh

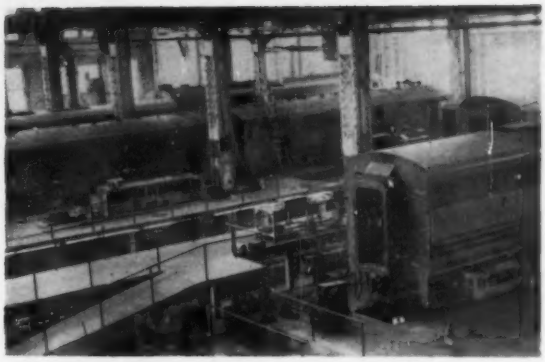
Personnel at the Lehigh Valley Railroad's Sayre shop have made many contributions toward reducing down time by developing special tooling and methods. Several of these are described.

DIESELIZATION on the Lehigh Valley Railroad was completed in October 1951. At present Lehigh's equipment includes a total of 223 diesel-electric locomotive units, and two Budd Rail Diesel Cars. Dividing these units into the several service categories, there are 125 switchers, 74 road freight, 10 road switchers (general purpose), and 14 passenger units. Normally these are operated as 162 locomotives.

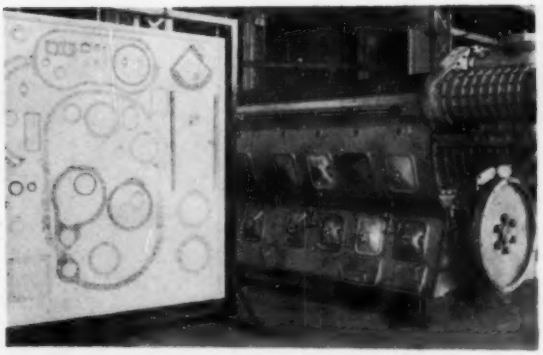
These figures may be compared with 363 steam and 50 diesel units owned in the latter part of 1947. The 50 diesel units, mostly switchers but including eight 1350-hp freight units (received in 1945), had otherwise been acquired a few at a time in the 20 years following the receipt of the first experimental diesel switching unit placed in service by The American Locomotive Company



Aluminum pistons for Alco 9-in bore engines are salvaged by machining off piston ring carrier and replacing it with new pre-machined carrier. This entails a shrink fit operation where the carrier is heated, the piston cooled, and then heliarc welding employed to weld the carrier to piston. A hydrostatic test, applied to the oil passages, is the final step.

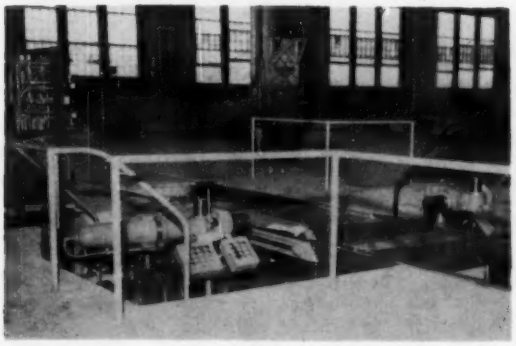


Running-repair section of the Sayre Shop is located in a corner of the former steam locomotive erecting shop. Convenient steps and ramps connect engine room floor level, shop floor level, and depressed floor level between tracks. Each level is equipped with the essential work benches and tools. Safety and cleanliness are musts throughout the shop.

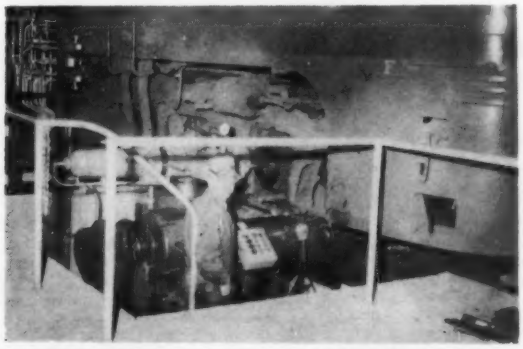


Storage boards for gaskets come in handy in the engine rebuilding section. This board is for the Electro-Motive Division Model 567-B engine but similar boards for other engine makes and models are also part of the shop equipment. Gaskets of irregular shapes and unusual sizes can be stored in this manner with proper shapes retained.

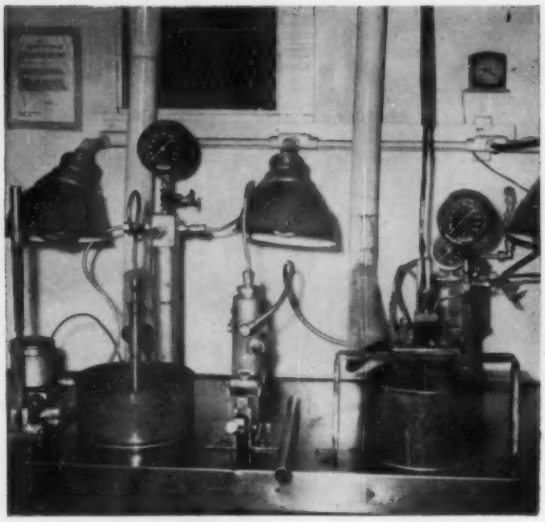
Lehigh uses a Nalco water treatment chemical in their diesels. By placing a dispenser in the locomotive engine compartment, treatment material can be added on the spot. The mixing cylinder is located in a flexible by-pass connection between the water pump and the jacket water header. The pipe wrench in foreground is not needed.



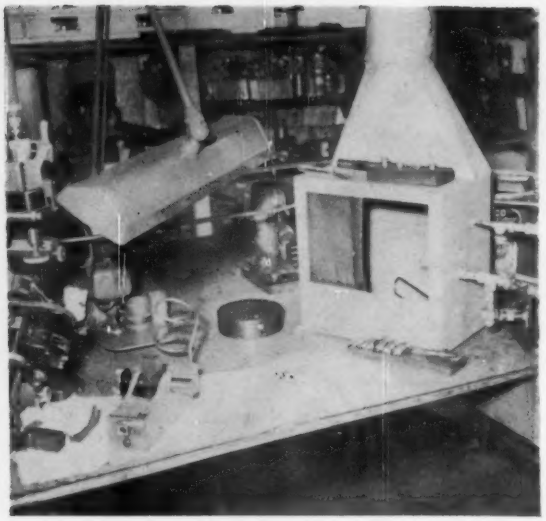
A wheel-truing machine is also part of the Sayre Shop equipment. This machine permits tread contour of wheels to machined in place. Where it once took two days to remove trucks, then remove wheels and true them in a lathe, the four pairs of wheels on a pair of two-axle trucks can now be trued in eight hours.



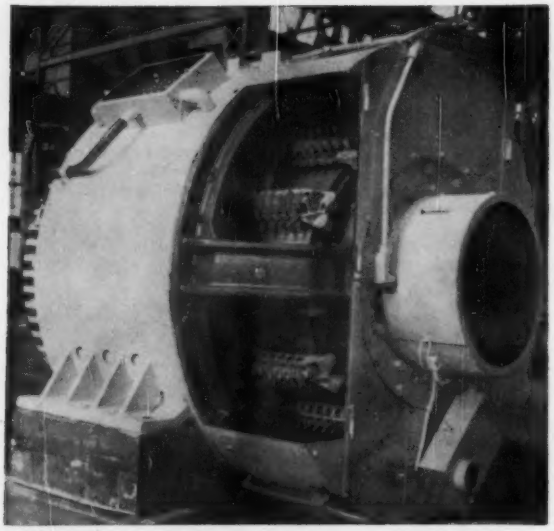
With the old method, even if only one or two pairs of wheels required turning, it still took two days. In actual operation, a multiple milling cutter trues the wheels as they are turned slowly. Naturally, a machine of this type represents considerable capital investment and must have sufficient work to make it pay off.



Sayre's injection equipment repair room contains equipment for the testing and reconditioning of fuel injectors. In addition, various types of Woodward governors are tested, reconditioned and adjusted in this portion of the shop. The electric governors used on Alco engines however, are returned to the manufacturer for service.



The box with the open front and exhaust at top is used for cleaning injector nozzles. This is done by use of a kerosene-compressed air jet blast. At left of illustration are grinding wheels for refinishing nozzle needle and also a nozzle seat honing device. As would be expected, the injector repair section of the shop is kept spotless.



On EMD type D-12 main generator housings, an additional terminal box has been mounted on the outside near the top. This was done to remove all AC shunt field and battery field wiring from underneath the generator where oil and water, collecting in the generator pit, posed a problem of grounds and sometimes fires.

When it comes to rebuilding exhaust manifolds for Alco Model 244 engines, this jig is used. This insures proper alignment of the various exhaust pipes and elbows during the welding operation, so that they fit exactly the exhaust outlets of the cylinder heads. At present, manifold parts are made of a cast Ni-Resist material.

on the Lehigh in 1927. In January 1927 this road had 927 steam locomotives.

Lehigh's dieselization program got well under way in 1948 when over 55 units mostly for road service, both passenger and freight, were placed in service. In the present diesel locomotive equipment three of the four principal locomotive builders are represented, viz., Alco, Baldwin, and Electro-Motive.

Maintenance and Repairs

1. Periodic Inspections—are made on trip, monthly, quarterly, semi-annual, and annual basis. Standardized lists of parts and assemblies to be inspected at each periodic inspection are followed. Maintenance adjustments, repairs, and replacements of parts or assemblies are carried out according to conditions disclosed at time of inspections, or as soon thereafter as practicable. Monthly inspections are made actually at 25 day intervals.

Trucks are removed and dismantled as necessary for required wheel and axle work, as well as for the cleaning and inspection of journal bearings. Traction motors too are removed and serviced according to overhaul schedules or as otherwise needed.

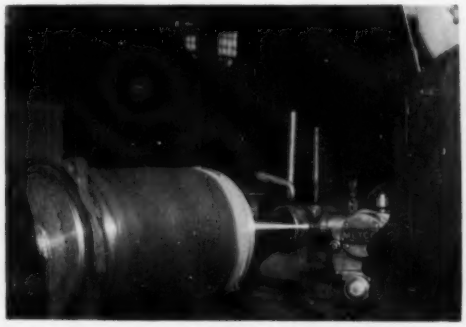
Classified repairs as outlined, are processed according to mileage or in the case of switchers, elapsed time, as shown in the following table.

Service	Reconditioning Repairs	Class 3 Repairs
Freight	180,000 to 240,000 mi	720,000 mi
Passenger	300,000 mi	1,000,000 mi
Switching	3 to 5 yr	7 to 10 yr

Main generator and traction motor overhauls scheduled are as follows:

In road service main generators are overhauled after 500,000 mi, and traction motors between 300,000 and 350,000 mi. In switching service main generators and traction motors are overhauled after 5 to 6 years service.

Cylinder liners are checked for out-of-round and wear with a bore gauge which makes use of a dial indicator. The length of the stem between the bore gauge contact points and the dial indicator is such that bore diameter can be measured at any point from top to bottom.



"Spray Bond" method is used for reconditioning the water-jacket side of the liner. The center and right illustrations show the application of "spray bond" and grinding to desired size, in that order. These jobs are done on lathes that formerly served steam locomotives.

2. Classified Repairs—are divided into two groups:

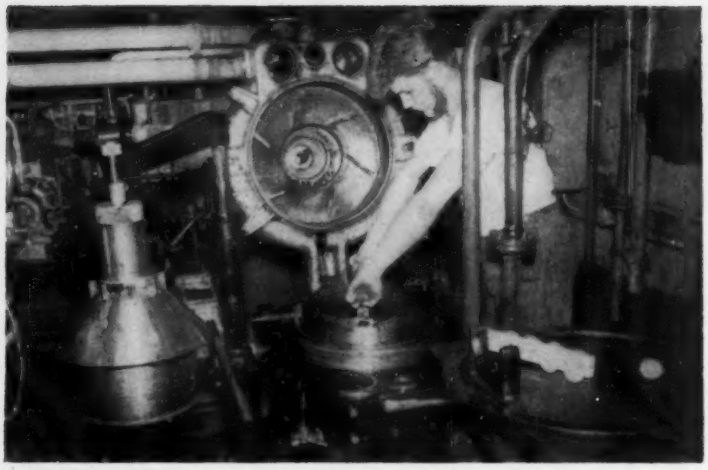
(a) *Reconditioning Repairs*—which consist of overhauling approximately one-half of the diesel engine, electrical components and auxiliaries. These include removal, inspection and reconditioning of power assemblies, and bearings, both main and connecting rod.

(b) *Class 3 Repairs*—are comprised of removing generators, cooling radiators and fans, air compressor, and other auxiliaries—both mechanical and electrical, including much of the equipment from the various panels. Draft gears, couplers, air brake equipment, and steam generators (where used) are also removed. All these parts go to appropriate sections of shop for inspection, reconditioning or replacement. Parts remaining attached to the car body are inspected and necessary repairs made in place. A complete paint job is done on interior and exterior of body.

Sayre Shop Assignment

Normally all reconditioning of parts and assemblies is done at Sayre shop, for the entire railroad. However, some work is shipped to the locomotive builders for reconditioning. The Sayre Shop turns out 4 road units and 2 switchers per month, after the units have received reconditioning and Class 3 repairs. This is in addition to the 125 monthly inspections done at this shop. The latter are also handled at 7 other points on the system, but engines are changed out at Sayre only. Traction motors are changed at Sayre and if necessary, at the other points.

Illustrated are some of the many tools, equipment, and procedures developed in this orderly, well organized diesel shop.



At left, discs are lifted from bowl with hydraulic lifter (pump handle at base of column). When disc stack is clear (above), liner is changed. Complete operation requires one operator.

Clean Heavy Fuel with Easier Bowl Cleaning

By Peter Stahl, Chief Engineer, Centrico, Inc.

Centrifugal separators of special design and accessories to speed up bowl cleaning are aimed at improving operation on No. 6 fuel oils.

HEAVIER oils such as No. 6 can best be used as diesel fuel after their two basic contaminants—insoluble solids and water—have been removed. Lube oil also must be cleaned of these two contaminants for efficient operation. Centrifuges offer a means of removing both the unwanted solids and water at the same time.

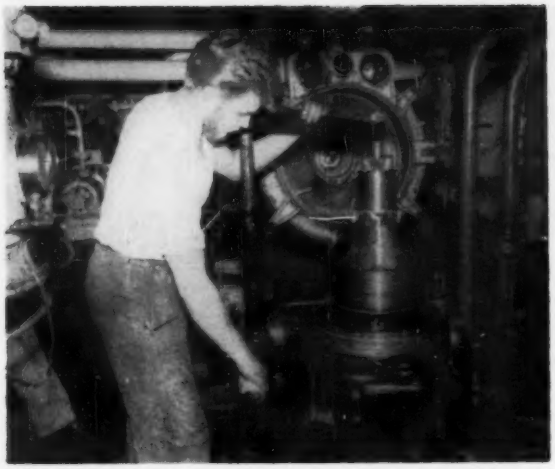
Various factors enter into determining the relative efficiency of a specific oil purifier model. Viscosity of the oil which affects the flow rate and more important, the efficiency of contaminant removal, is controlled by heating the oil ahead of the centrifuges for the most efficient processing. All centrifuging depends upon the relative specific gravities of the component parts of the liquid being processed.

The effective throughput capacity of any purifier is determined by a combination of the above characteristics and others. These include the volume of contaminants plus the unit's physical properties, such as disc design and area, bowl size, sludge room, and speed, as well as its suitability for high-temperature operation.

Westfalia engineers feel that a pair of centrifugal separators are required to do a complete heavy oil processing job. In the first unit, oil is purified—cleaned of all water and most solids. Operating as a clarifier, the second unit rids the oil of any solids that may have passed the purifier. The two-stage technique is preferred for complete purification because of the relatively unstable quality of heavy oils and the need to keep contaminated fuels from the diesel's injection system.

With these factors in mind, the Westfalia Model OG separators were designed particularly for heavy oil purification. To prove the effectiveness of the development, a

**Centrico represents Westfalia Separator A.G., Oelde, Germany*



When the clean liner is in place, discs are swung into position and the bowl sealed. Sludged liner is then readied for next changeout.

pair of Model OG-8016 separators (purifier-clarifier) were recently subjected to independent and competitive tests supervised by a leading oil company at a Dutch shipyard. Using the two-stage procedure, they turned in the most efficient performances, purifying No. 6 oil with a viscosity of 3300 SSU at 100°F (128 SSF at 122°F), even at a feed rate of 800 gph.

Bowl cleaning is always a problem with heavy oils and this was given consideration in the designs. Both the conventional Westfalia marine-type separator, the MOC models, and the special heavy-duty Model OG units have been fitted with auxiliary cleaning equipment—a hydraulic lifter for the upper bowl assembly and disc set, and exchangeable bowl liners to catch the sludge.

These accessories reduce out-of-service time by at least 60%. One man can do the whole job. The hydraulic lifter is swung over the centrifuge after the hood and bowl are opened. It picks up the upper bowl and the complete disc set and swings them away. The sludge-filled liner is removed and replaced with a clean one.

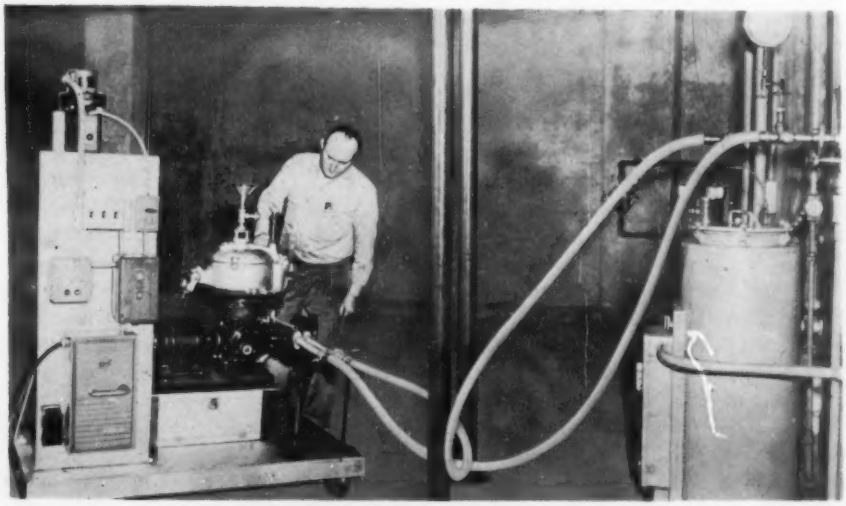
While liners are being changed, the disc set should be dipped into light diesel oil to loosen the sludge. This centrifuges out when operation is resumed. The contaminated liner is cleaned at leisure and held for reuse during the next cleaning period.

A third model for mention, Model SAOG, approaches the bowl-cleaning problem differently. It virtually eliminates cleaning down-time because it removes sludge periodically and automatically while the purifier is in operation. This "de-sludger" is used preferably as a purifier, followed by a regular OG or MOC clarifier.

Only two more parts are required in the de-sludger bowl than in the conventional marine-type separator. Construction is sturdy and simple. When the bowl is full of sludge, the feed valve for oil and water is closed. The operating water valve is opened for 5 or 6 sec. This lowers a "de-sludging ring" at the outer periphery of the bowl and exposes the discharge channels, releasing all of the solids.

Three or four seconds later, the operating water valve is turned with a quick open-shut motion to allow a little water to compress and force the de-sludging ring firmly back into place. The bowl is then filled with hot water and the oil feed valve opened.

Improved designs and added accessories go a long way toward more satisfactory operation on No. 6 fuels. Fuel will be cleaner with the result that abrasive wear and damage to injection equipment will be minimized. Attention to the bowl cleaning problem will reduce out-of-service time and make the job a lot easier.



At Nassau County's East Rockaway, New York, Sewage Treatment Works, a portable unit is used to clean lube oil during operation of any of five engines.

Mo-Pac Builds Governor Test Bench

To facilitate checking and adjustment of diesel engine governor units, Missouri-Pacific Lines constructed its own test bench.

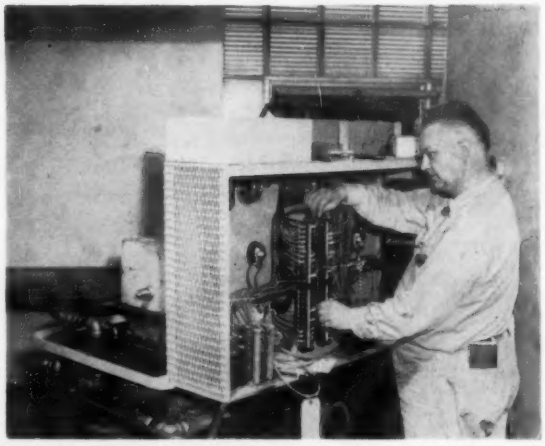
EXPERTS in diesel locomotive operation and maintenance generally concede that the engine governor unit is second only in importance to the locomotive storage battery insofar as engine operation is concerned. The highly-sensitive governors on the diesel engines of Alco locomotives are precision electro-hydraulic devices which must always be at the peak of perfection for good locomotive performance and control.

But in normal use a governor's sensitivity deteriorates and hence requires periodical examinations and adjustments to restore the original, and very essential sensitivity.

Test-benches are available commercially for this purpose, but Missouri Pacific Lines undertook to build one of its own in the electric shop of its diesel facility at Kansas City. Developed by W. C. Hardin, Mo. Pac's electrical foreman there, this piece of equipment was only recently completed and placed in operation. The relatively clear bench top and simple-looking backboard conceal an array of pipes and valves, and a formidable maze of electric wiring.

All this is by way of simulating the actual conditions of engine operation and providing the means to observe the behavior of governor units under test on the new bench. The test-bench allows the operator to determine with accuracy if the governor will, or can, do the things it should do under normal functioning in the locomotive.

Until the new test-bench became a reality there was no precise way of determining if governors were functioning within the permissible limits of their sensitivity. They were removed from locomotives on annual inspection basis, perhaps partially disassembled and cleaned, then returned to service.



View of the rear of the back panel board showing the intricate electrical harness being examined by Mr. W. C. Hardin, electrical foreman, who was responsible for development of the test bench.

Now each unit is completely disassembled and magnafluxed for hidden structural defects. Operating parts are precisely measured, and if not within the limits of original dimensions, some as close as 0.0003-in, new parts are installed. When reassembled the governor unit is mounted on the test-bench and run through a series of severe tests to determine if it performs within the specified limits which permit of scant tolerances.

Basically, the Alco engine governor maintains and adjusts the engine speed and regulates the amount of fuel the engine can use safely. With uncanny mechanical judgment, the sensitive governor controls the loading of the diesel engine by the main generator and anticipates when

there will be additional load applied, with corresponding demands for fuel, previous to actual load demands. It allows maximum horsepower transfer without overloading. Of course, the governor works in reverse just as precisely when decelerating the engine and reducing the load.

Controls on the test-bench simulate these locomotive operating conditions, besides providing means for complete observation and accurate check of other factors affecting diesel performance. Shaft seals may be examined for possible oil leaks and power pistons checked for "blow-by". The number of degrees of governor main shaft rotation may be checked, and clutch arms tested for correct residual magnetism.

Operation of the speed and fuel limiting solenoids can be accurately observed and properly adjusted. When set up to check governor performance under varying conditions of engine loading, the test-bench instrument readings will reveal the amount of speed droop and corrections can be made on the governor to hold this falling-off to a minimum.

The test-bench incorporates an amplidyne exciter to provide the variable characteristics encountered in actual engine operation. An 1800-rpm air-motor, controlled by the governor, drives a 500-watt, DC electric generator, which simulates the output of the diesel locomotive's main generator.

A 2-pole tachometer generator, V-belted from the air-motor shaft, is used to measure speed and to operate the speed solenoid and the S.A.R. relay, the same as on the locomotive itself. A motor driven oil pump furnishes oil for the power-piston operation. This includes an arrangement of valves to fill, run, or drain the governor. The test-bench has a 10-gal oil storage tank equipped with a large permanent magnet in the bottom to attract and hold any stray metal particles, which may have gotten into the oil system.

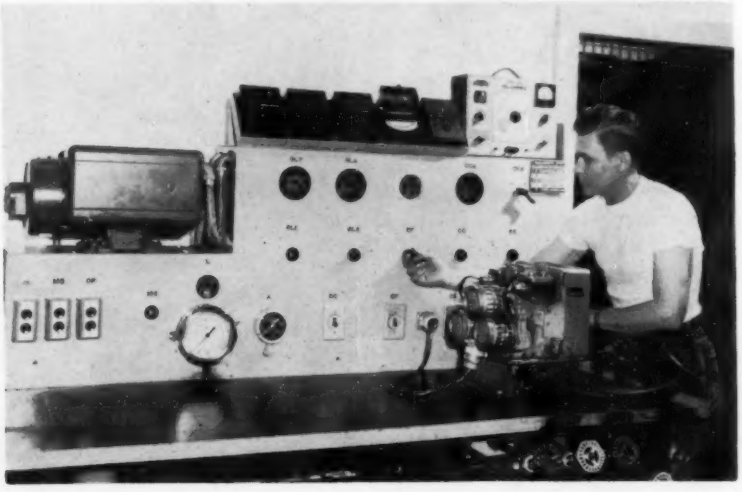
A remote motor-generator supplies 75-v DC for the fuel limit circuits, again simulating actual locomotive operation. To drive the amplidyne 440-v AC is supplied to the test-bench. Fig. 1 shows the arrangement of meters and control knobs which enable the operator to set up any combination of simulated operating conditions, to determine governor performance characteristics. The amplidyne is at top left, with portable meters ranged along the top of the rear panel board.

These meters are used to check balance currents, wheel-slip relays and other relays used on Alco engines. The capacitor tester is at top right. All these instruments are also used in conjunction with another test-board designed to check the speed control and excitation panels of Alco engines.

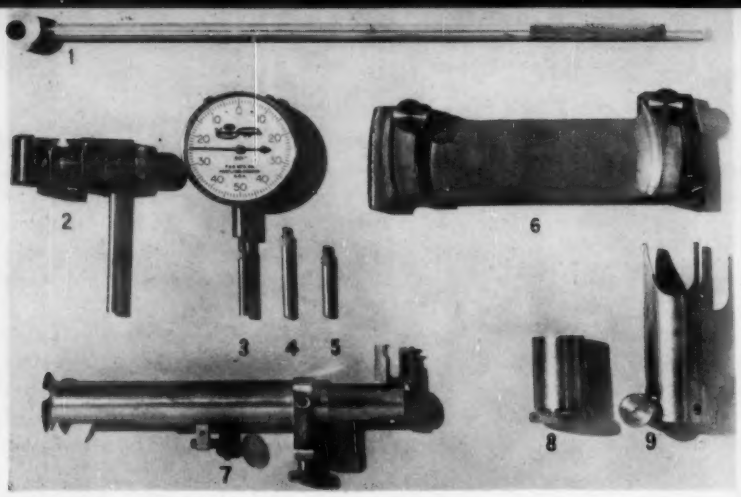
The permanently-installed instruments include those marked as GLV, generator voltmeter; GLA, generator ammeter; GL1, generator potentiometer, and amplidyne feed-back; GL2 potentiometer for generator only; EF, exciter field; CC, clutch coil rheostat; SS, speed setting potentiometer; CCA, clutch coil milliammeter; ECS, engine control switch; three push-buttons, lower left, are motor amplidyne, motor generator, and oil pump; the MG knob adjusts the 75-v DC supply read on voltmeter L.

The large dial is a laboratory gauge to set the oil pressure regulator in the governor, while A is the air-motor air gauge. DC is a switch in the DC voltage circuit; EF a switch in the exciter field circuit; CS, the clutch-shorting switch; hidden behind governor unit is DSS, which desensitizes the governor. Meter not marked at top center is a conventional GE speed tachometer. Fuel limit and speed coils are set from readings with a portable milliameter. Hand valves at lower right, under bench-top, control other operating phases of the test-bench.

While the test-bench was developed by Mr. Hardin, and built under his supervision in the electric shop, A. J. Daniel, master mechanic for Missouri Pacific at Kansas City. gave his full cooperation and co-ordinated the work of various other shop crafts participating in the construction details.

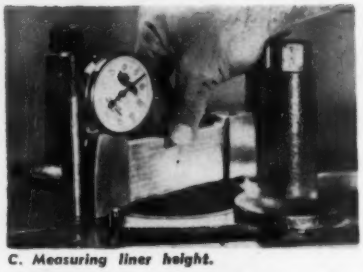


Operators eye-view of the test bench at the Kansas City electrical shop. Unit on bench is connected for test.

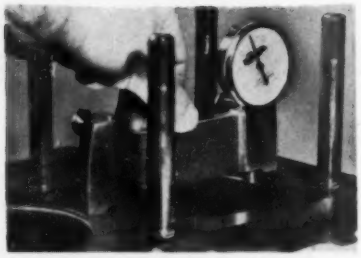


A. Components of Overhaul Kit.

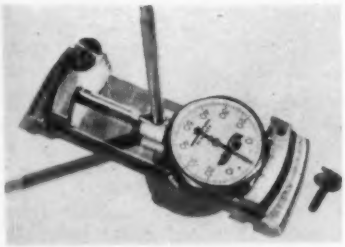
B. Setting gauge.



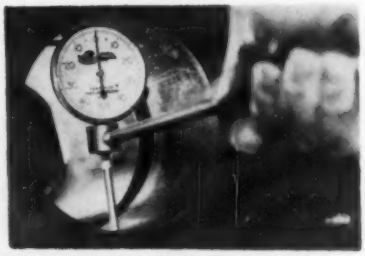
C. Measuring liner height.



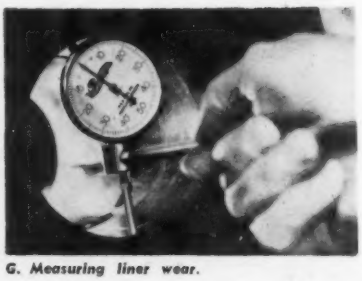
D. Measuring counterbore depth.



E. Setting for bore measurement.



F. Measuring bore in block.



G. Measuring liner wear.

Valve-Gapper Overhaul Kit

WHEN the "Valve-Gapper" appeared on the scene it constituted a new approach to setting overhead valves. It took the "feel" out of the job by substituting a dial indicator for the old feeler gauge to give precision clearance readings.

Provision was also made for injector timing and fuel rack setting on GM Series 71 engines. Now, through the development of several adapters, its application has been broadened. Following is a description of the new kit and how it is used.

(A) P&G valve-gapper overhaul kit for GM-71 Series diesel engines, especially designed and made for mechanics and overhaul shops. Special adaptors permit use of dial indicator for measuring height of cylinder liner, uniformity of counterbore, uniformity of cylinder bore, and cylinder liner wear. Complete set includes: (1) dial indicator handle; (2) "D" engine control tube adaptor; (3) dial indicator (special 3-point); (4) standard-cylinder bore; (5) standard-cylinder liner; (6) combination master gauge and holder; (7) valve-gapper; (8) micrometer plug gauge; (9) timing attachment.

(B) Measuring height of cylinder liner: place dial indicator in high side of the master gauge, tighten set screw and place master gauge on a smooth part of block. Zero dial indicator needle by turning dial rim.

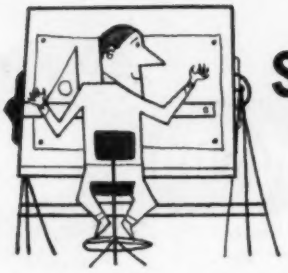
(C) Position gauge across cylinder with feet on block and dial indicator rack on the cylinder liner rim. Dial registers proper height of liner in relation to cylinder block.

(D) Measuring uniformity of counterbore: place dial indicator on low side of the master gauge, set gauge across cylinder bore with dial indicator rack resting on bottom of counterbore; then set dial to zero and rotate gauge, checking as many points as desired.

(E) Measuring cylinder bore: screw No. 4 standard into indicator rack, place handle on dial indicator and set dial indicator in master guage, as shown, with all three points touching. Then set needle to zero by turning dial rim. Master gauge is exact diameter of cylinder bore.

(F) Dial indicator is then lowered into cylinder bore, using rocking motion to find minimum diameters.

(G) Measuring cylinder liner wear: change standard to No. 5. Using new liner, or top edge of liner being measured, as a gauge, set dial to zero, lower dial indicator into cylinder liner and follow same method as in checking cylinder bore. Dial indicator registers exact wear to .001 in, in both operations.



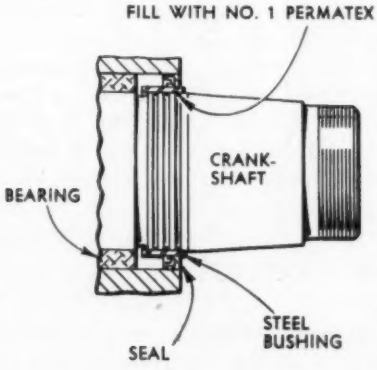
service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

Cat—Crankshaft Oil Seals—D7 and D8 Starting Engines . . . .

Starting engines on D7 and D8 tractors have a clutch designed to operate in a dry compartment. On extreme slopes, small amounts of oil from the starting engine crankcase sometimes leaked past the rear main bearing and into the starting engine clutch compartment. While a drain plug is provided to drain off any accumulated leakage, this was not always done and starting engine clutch slippage resulted.

Some time ago a synthetic rubber lip type seal was assembled on the crankshaft at the flywheel end. This seal has very effectively stopped oil leakage into the clutch compartment even on the steepest slopes. This improvement was adaptable to all D7 and D8 starting engines, but it required that the cylinder block and



pan be counterbored and that a new crankshaft without oil return threads be installed. For this reason the addition of a crankshaft seal to earlier starting engines was hardly economical unless the crankshaft was worn beyond reclaimable limits. Many owners added the starting engine crankshaft seal when the engine was reconditioned.

Cat has recently released a very inexpensive sealing arrangement for quick, easy installation on D7 and D8 starting engine crankshafts. Installation requires no machining of the block or pan and the existing crankshaft with oil return threads can be used. This ingenious arrangement is indeed the answer to the question, "Is there a better way?"

The 3H6877 field changeover group includes a seal, bushing, and bearing, which provides the same effective rubber lip type seal as used on later starting engines. The bushing fits tightly over the oil return screw of the crankshaft and forms a surface for the seal. The new main bearing is shorter than the original main bearing in order to provide space for the bushing and seal. For easy assembly, complete installation instructions and drawings are also included with each group. With this sealing arrangement installed, oil leakage at the starting engine rear main bearing and resultant clutch slippage can be quietly overcome.

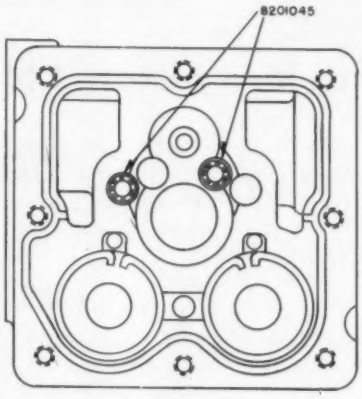


Fig. 1

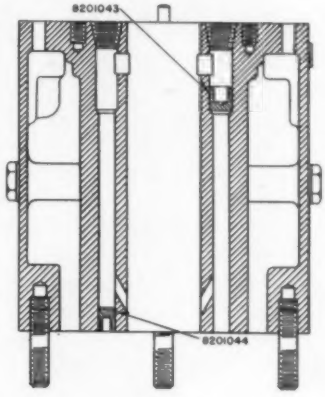


Fig. 2

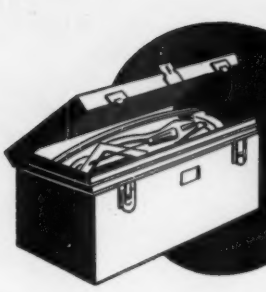
EMD—Governor Check Valve Removal—All Engines . . . .

The use of pump intake and outlet check valves in Woodward governors has been discontinued by EMD. The sole purpose of these check valves was to permit operation of governors on engines with either clockwise or counter-clockwise rotating governor drive shafts. Since the governor drive shafts of all EMD engines rotate clockwise, it was decided to eliminate the two ball check valves which were always unseated and to replace, with solid plugs, the two which were always seated.

This change will be incorporated in all PG and SI governors rebuilt at EMD branch shops. It is recommended that when any governor having check valves is overhauled, the check valves be removed and the solid plugs installed in the proper locations as shown in Figs. 1 and 2.

Fig. 1 is a view of the bottom face of the PG governor power case showing the location of the two plugs.

Fig. 2 is a cross-section view of the SI governor power case viewed from the side opposite the power cylinder mounting pad, showing the location of the upper plug No. 8201043 and the lower plug No. 8201044.



Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Railroad Idea Adapted to Marine Use

GEORGE SWEDE, HASBROUCK HEIGHTS, N. J.—I thought that you might be interested in the way that some of your articles get around. You had one recently on special tools developed by the Reading Railroad. We adapted one of the ideas for use on our tugboat.

We have one thing in common with the railroad. Our engine is the GM Model 567, the same model used in the locomotives. One difference is that while most of the tooling was for expediting overhaul of many engines, we are only concerned with one. Yet, I got one idea for use in our engineroom. It was the stand used to hold the cylinder heads while cleaning and servicing.

The design was adapted to hold a single head and after much measuring and sketching, it was built to fit over the main sea strainer cover box where all our heavy work is most conveniently done. It was built to be removable because space is a problem at best. Brief experience gained in cleaning only five heads showed that the work could be done easier and faster and with greater safety to the man doing the work. There is less danger of damaging the head in the process too.

With our progressive system of maintenance, we change one head at a time until the job is done. The head is serviced in the interval to the next layover period while the tug is in operation. The men all like the stand and wonder why we didn't think of it earlier.

Thanks, Mr. Swede. You bring out a point that we have tried to emphasize for years. Few of our articles are so specialized that they apply only to one field. A railroad article helps a marine man, a tractor article helps a trucking man, on such subjects as lube oil or filtration cut right across the board. No one has an exclusive corner on ideas. We hope others see the point.—Editor

Simple Speed Reducer for Tool Conversion

LOUIS RIEBEL, POMEROY, OHIO—Our shop was asked to adapt separate electric drive to a drill press formerly driven from a line-shaft. All this was 70 miles away. The motor supplied turned 1800 rpm and the drill press spindle was to turn at about 300 rpm. The motor had a 4-in pulley and so a direct drive was out; the spindle pulley would need at least a 20-in diameter.

We decided to build an assembly as a unit to avoid construction on the job. Motor, pulleys, and a jack-shaft were all assembled in a box, 2-ft by 2-ft by 20-in high. One shaft bearing was held by a bracket made of channel iron, and the other was bolted to the side of the box. A drilled hole let the shaft-end protrude. The 4-in motor pulley turned a 10-in pulley on the jackshaft. Shaft speed was 720 rpm. A 4-in pulley was mounted on the shaft extension and a 9-in one on the drill press. This gave us about 320 rpm on the spindle.

The box was fitted with a mesh door, faced away from the work. to permit air circulation while keeping oil and metal chips, etc., out of the drive. Such a neat little hookup is handy when converting drives on older tools. The box gives maximum protection from dirt and the whole thing can be built at low cost mostly from materials around the average shop.

news of our industry

Number 64

Recently loaded aboard the Moore-McCormick liner Moormacsea was the last of 64 diesel-electric locomotives bound for Uruguay. This progressive country—called "the Switzerland of South America"—will soon have the most completely dieselized rail transportation system in the world.

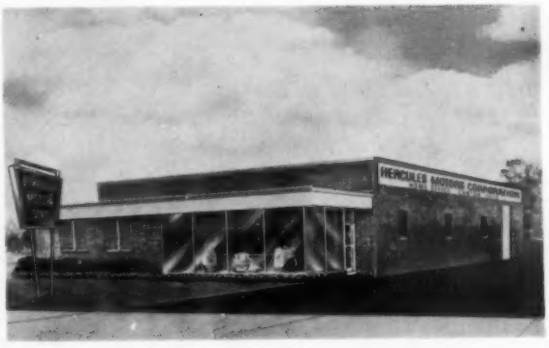
More than $10 million worth of new locomotives, which will replace oil-burning steam locomotives averaging 45 years old, were purchased from the International General Electric Company here.

Fifty of the locomotives are mainline units which will haul both passengers and freight. The other 14 are slated for switching service and for duty in areas where traffic is lighter. Freight loads are mainly wool, hides, skins, and meat, which comprise 97% of the country's exports, and petroleum, coal, machinery, and consumer goods which make up its imports.

New Hercules Branch

To better serve the Southeast, the Hercules Motors Corporation has opened a new factory branch located at 400 South Edgewood Avenue, Jacksonville, Florida. The new branch will serve as a parts warehouse for Florida, Alabama, Georgia, and South Carolina. Facilities of the factory branch include a large sales room, modern offices, complete parts department, and a fully equipped repair shop.

A large stock of service parts will be maintained at all times to provide an immediate source of parts for users of Hercules diesel, gas, and gasoline engines. Hercules engines will also be available for immediate delivery from Jacksonville.



new products . . . . . page 56

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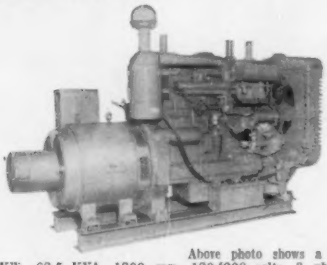
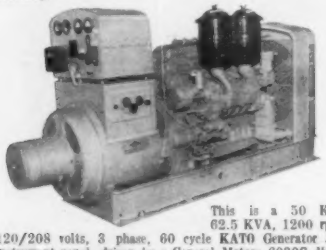
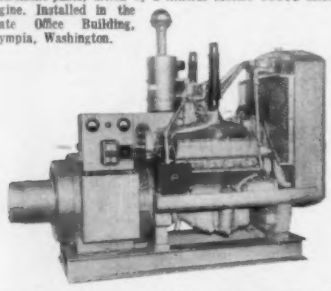


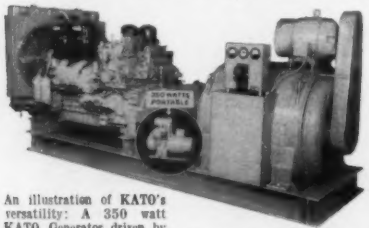
Above photo shows a 50 KW, 62.5 KVA, 1200 rpm, 120/208 volts, 3 phase, 60 cycle KATO Generators and instrument panel, driven by an International Model UD-18A diesel engine. Installed for the Mechanical Construction Division in Salt Lick, Kentucky.



This is a 50 KW, 62.5 KVA, 1200 rpm, 120/208 volts, 3 phase, 60 cycle KATO Generator and instrument panel, driven by a General Motors 6030C diesel engine. Installed in the State Office Building, Olympia, Washington.



This pictures a 75 KW, 93.5 KVA, 1800 rpm, 240 volts, 3 phase, 60 cycle KATO Generator and instrument panel, driven by an H-540 LeRoi engine utilizing natural gas for fuel. Installed for Republic Steel Corporation of Gary, Ind.



An illustration of KATO's versatility: A 350 watt KATO Generator driven by a Lauson LMH engine and a 150 KW, 187.5 KVA, 750 rpm, 120/208 volts, 3 phase, 25 cycle KATO Generator and instrument panel—driven by a General Motors twin 6-71 diesel engine. For Duluth, Mesabi & Iron Range Railway.

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news of our industry

New Head of SAE

Carl George Arthur Rosen, consulting engineer to the president of Caterpillar Tractor Co., has been inaugurated as the 1955 president of the Society of Automotive Engineers.

C. G. A. Rosen

Mr. Rosen is a past vice president of the society. He is said to have been largely responsible for the development of the first diesel engine in a Caterpillar crawler tractor, produced in 1931. Before joining Caterpillar, he was chief engineer of Dow Pump and Diesel Engine Co. where he was associated with the design and installation of diesel engines in The Libby Main, one of the forerunners of American diesel vessels. He has been with Caterpillar since 1928.

RDCs Aid Local Traffic

With the advent of the rail diesel car, the popularity of local trains is beginning to be restored on American railroads. Railroads which had abandoned these runs except for commuter service have found that they can now cut their losses or increase their profits through the use of these light cars.

Over a branch of the New York, New Haven & Hartford, for example, on which regular service was dropped over 25 years ago, an RDC now travels three times a day. Two men, the engineer and conductor, can operate the rail car whereas the old train required a crew of four.

The car has a governed top speed of 85 mph. Its power, because of automatic transmission, is smooth and flexible. An RDC takes only one minute to make a stop, an ordinary train five. From a standing start, it can cover 5 mi in 5 min and comes to a halt from 80 mph in about half a mile. No time is lost in reversing direction at the end of the line, the engineer just carries his throttle and brake handle to the cab at the other end.

As for maintenance, the car is said to be in the shop very infrequently. Since the car can run on either of its two diesel engines of 275 hp each, and which are located under the car, in case of need the engines can be rolled out and replaced anywhere along the line in about an hour. A brake shoe is replaceable in less than a minute.

The New Haven estimates it costs about 64c a mile to operate the average RDC, which is about half the cost of running a conventional train. About 116 of these cars are operating on American roads to date, and more are being ordered.

New York Engineering Offers

The Civil Service Commission of the City of New York announces that it is issuing applications for positions in the engineering field. Vacancies exist for electrical engineering and mechanical engineering draftsmen, junior electrical and junior mechanical engineers. Salaries start at $4080 a year.

Applications will be issued and received, in person or by mail, up to March 23 at the Dept. of Personnel, 96 Duane St., New York 7, N. Y. A $3 fee is required for filing and applications requested by mail must be accompanied by a self-addressed stamped 9-in envelope.

B&O Orders More Diesels

The Baltimore and Ohio Railroad announces it has placed orders for 86 diesel-electric units, delivery to begin in April and finish in June. The new order is for 29 900-hp yard switchers, 28 1750-hp 4-motor road switchers, four 2400-hp road passenger units, two 1750-hp 6-motor road switchers, 11 1000-hp yard switchers, and 12 1600-hp 4-motor road switchers.

Completion of the order will give the road a total of 948 diesel units. Concentration of diesel power will then be 82% for freight service, 86% for passenger service, and 80% for handling yard switching.

news of our industry

Material Handling Seminar

Companies desiring to cut handling costs are being invited to send a representative to the Second Annual Material Handling Training Conference to be held June 19 through July 2 at Lake Placid, N. Y. Organized by James R. Bright, Harvard Business School lecturer, aim of the conference is to provide a practical, how-to-do-it training program for the solution of problems encountered daily.

It will consist of a 2-week, 90-hr study course set up to encompass all phases of modern material handling and storage. More than 200 kinds of equipment will be analyzed and latest developments examined. Eighteen experts in a particular type of handling will constitute the teaching staff. Information may be obtained from Director Bright at the school, Boston 63, Mass.

British Rails Up Diesel Orders

The state-owned British railroad system announces it plans to introduce more multiple-unit, lightweight diesel passenger trains in its services. Orders involving $2,800,000 have been placed. This is in addition to $5,600,000 worth ordered early last year.

The new orders are for 43 sets of power equipment and 21 sets of trailer car equipment. The units will be installed in six areas to replace or add to steam service. In Yorkshire, for example, the locomotives are expected to cut operating costs about $24,400 a year. The new program is an addition to a 5-yr plan for placing 573 diesel shunting locomotives in service by 1957.

B-L-H Gets Belgium Order

Announced by Baldwin-Lima-Hamilton Corp. is receipt of an order for four 65-ton diesel-electric industrial locomotives from Usine Gustav Boel, La Louviere, Belgium. Each unit will be powered by two Hercules 300-bhp, 6-cyl diesel engines, and will develop a tractive effort of 32,500 lb at 25% adhesion.

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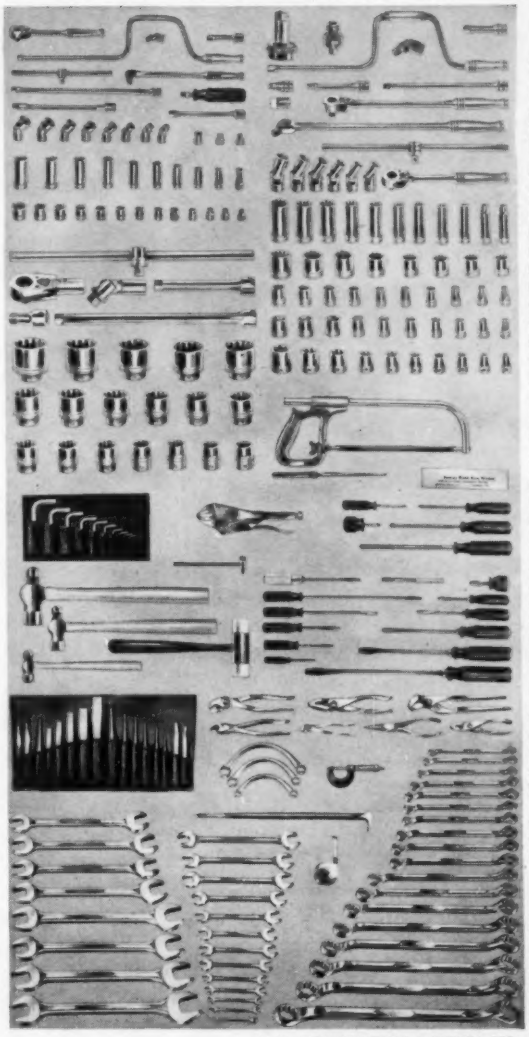

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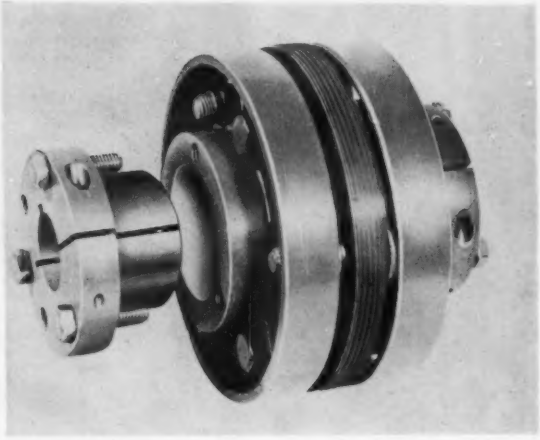


Flexible Coupling

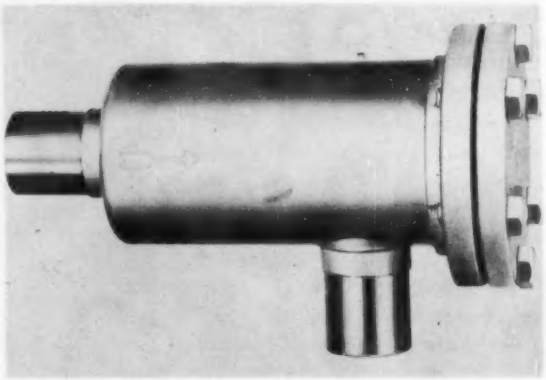
A line of heavy-duty flexible couplings, equipped with split-taper bushings for quick mounting, was recently announced by Climax Metal Products of Cleveland, Ohio. In addition to providing easy shaft handling, the split-taper bushing reportedly enables the Climax QD coupling to be used to connect shafts of different sizes. The handy bushing is said to also simplify close coupled mounting, as the bushing may be locked on the shaft by means of a cross bolt, and the coupling then drawn up by means of the jack screws.

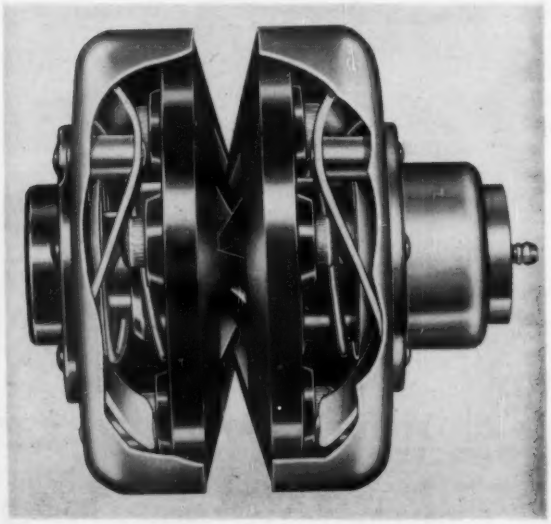
The split-taper bushing is of 1-piece construction, with a socket-head cross bolt across the compression slot. Detailed information is available from the company at 863 East 140th Street, Cleveland 10, Ohio.

Strainers

Detroit Controls Corporation is now offering a complete line of strainers designed to protect valves and pumps in all fluid systems. They are produced in cleanable and non-cleanable models, fabricated from ferrous and non-ferrous metals, according to the manufacturer.

The strainers are reportedly built with reinforced monel and stainless steel screens of 60 and 80 mesh with up to 180 sq in of screen area. Finer meshes are also available. For further information, write the company at 5900 Trumbull Avenue, Detroit, Michigan.





Variable-Speed Pulley

Infinitely variable speeds from a constant-speed motor are possible with the new Hi-Lo automatic pulley, according to the Equipment Engineering Company which designed the pulleys to handle a wide variety of operations.

By turning a handwheel on the Hi-Lo standard base, the motor assembly is moved toward or away from the driven pulley, allowing a standard vee belt to run over the various pitch diameters. Movement toward the driven pulley produces maximum speed variation, while movement away produces the minimum.

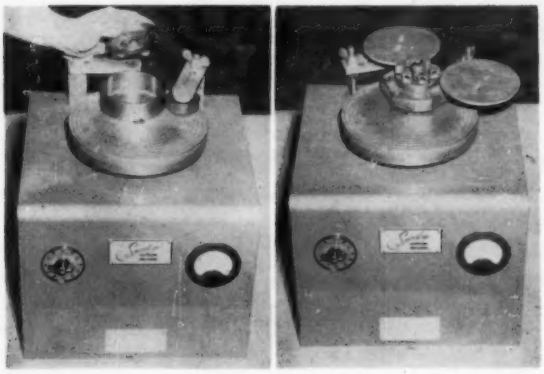
The pulleys are made in seven models, the model depending on the size of the motor involved. Maximum horsepower recommended (at 1750 rpm) ranges from ½ to 5 hp. Pulleys are also available with dual-ratio and countershaft bases. For additional information and specifications, write Dept. KP, Equipment Engineering Company, 2853 Columbus Avenue, Minneapolis 7, Minn.

Flat-Lapping Machine

"Spiralap", as it is called, is a rotary flat lapping machine which has been designed to give the operator a high degree of flexibility in the semi-automatic lapping of flat surfaces. Designated the Model SPL-9A, the unit is contained in a fabricated steel case. A ¼-hp motor, driving through bevel-gears and belt and pulley powers the lapping plate.

Three cast iron plates of 9-in diameter are included with the unit. These are charged with "900 compound". Also included are a time shut-off switch, hour meter, lap ring, and rotating guides. The time-shut-off provides a maximum operation of one hour without resetting, the longest time recommended for work should be left on the machine without attention.

The hour meter registers the total number of hours the machine has operated and helps to determine when plates require re-lapping. The lap ring is for holding small work while it is being lapped. To locate work on the lapping plate and keep it rotating, the ball bearing guides are provided.



The three lapping plates when new are carefully lapped and mated to form a set. All three bear the same serial number, but each with a different letter, viz., A,B,C. It is recommended that the plate marked A be placed on the machine first. When it requires re-lapping (to be established by experience), plate B should be placed on plate A for about 15 to 30 min. Then B takes the place of A which is set aside. At the end of the second work period, plate C is allowed to ride plate B for the required time and is then used for the third work period.

The establishment of the appropriate time necessary to re-lap the plates and the length of time actually required to make the work being processed commercially flat, is materially assisted, according to Spiralap, by the use of an optical flat and a monochromatic light, which are also available from the company at Wilmington, California.

FRAM Water Separator & Fuel Filter ends corrosion, rusting, pitting with 100% water removal

Here's how FRAM's *double-action* Water Separator & Fuel Filter gives your fuel injectors complete protection:

1. **100% WATER REMOVAL** Removes all water before injection . . . saves costly injectors from corrosion, rusting and pitting!
2. **TRAPS DIRT AND DUST** FRAM Filtration traps and removes dangerous dirt before it reaches injectors . . . ends abrasive action!

Save on injector replacements . . . cut down-time! Write for information on FRAM Water Separator & Fuel Filter today!

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OIL • AIR • FUEL • WATER
FILTERS

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Providence 16, R. I.

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SAVE MONEY ON DIESEL UPKEEP

free booklet tells how . . .

THIS illustrated booklet contains a wealth of sound, practical ideas to expedite Diesel maintenance, keep operating costs low and extend equipment life. Gives details on such subjects as:

- Cleaning filters
- Desludging lube oil coolers
- Descaling jacket water coolers
- Degreasing engine parts before repair
- Steam-detergent cleaning
- Plant maintenance cleaning

Booklet also discusses tested Oakite procedures for streamlining maintenance in steam control stations and electric power plants.

FREE copy of this 44-page booklet yours on request. Consult your local Oakite Technical Service Representative. Or write address below. No obligation.

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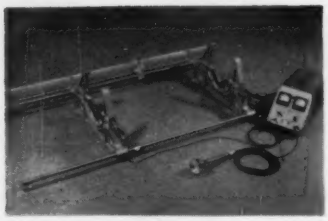


Dynamic Balance Stand

To make its vibration analyzers efficient in balancing individual rotating parts, International Research & Development Corp., Box 1707, Columbus 16, Ohio, has developed a new dynamic balance stand. A vibration analyzer is instantly attachable for use wherever needed.

The stand balances armatures, gears, flywheels, sheaves, etc., to vibration tolerances as fine as .00025 in. It features mechanical plane separation to eliminate cross effect of imbalance from one end of a rotor to another. Its suspended saddle assembly is locked at each correction plane during balancing operation and after the phase of imbalance is established only one run at each end of a rotor is usually said to be required.

The bench-mounted 75-lb stand includes two freely suspended saddle supports to hold the part being balanced, two sensitive velocity pickups, a selector switch, and a structural frame with adjustable length between saddle supports. It has a 30- to 500-lb capacity. Parts up to 24-in diam and 4-ft, 3-in length are claimed capable of being accommodated without modification.

Hydraulic Hose and Couplings

Surgepruf is the trade name of a new line of hydraulic hose and couplings for medium-high and high pressure service announced by Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa.

The couplings feature a double-wedge grip which the manufacturer states makes assembly possible on rubber-covered hose, without skiving. Through use of a special slotted bushing, retightening of the coupling on the hose without disassembly is possible if it comes loose through vibration or flexing. No special tools or mandrels are required for assembling.

Set Screw for Double Set Users

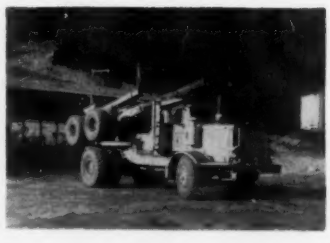
Set Screw & Mfg. Co., 190 Main St., Bartlett, Ill., is introducing a set screw with a pivot shaft point for use as a locking or adjusting screw in double screw installations. Called the Pivot-Lok, it is claimed to eliminate damage to the second screw and prevent loosening due to turning of the ganged screws as one.

The new screw has a shaft protruding from its end which is pointed and fits into the socket of the screw ahead of it that is to be locked or held in adjustment. The point on which the top screw turns provides the only contact between the two screws. Both screws may also be easily removed when desired.

New Diesel Log Hauler

The pictured log hauler, now on operation at a logging company in British Columbia, was recently introduced to the Northwest logging industry by Euclid Div., General Motors Corp., Cleveland 17, Ohio. Loads averaging more than 20,000 board feet are being hauled with the machine over difficult roads, a distance of about 7 mi. Savings of 15 min on both the loaded and return trip are claimed.

This single drive-axle truck, called the Model TD, utilizes tires several sizes larger than those on conventional highway trucks with tandem drive axle. Components of the hauler include a 300-hp diesel engine, Allison Torqmatic drive, No-Spin differential, and power steering. Rated capacity is 120,000 lb with 14-ft bunks and 50-ton trailer.



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Cedar Falls, Iowa

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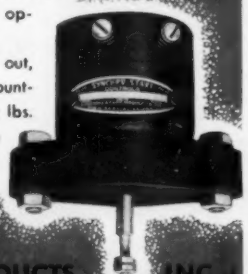
SOLENOIDS

6, 12, 24, 32 VOLTS • 10 LB. PULL OVER ½"

For operating throttles, chokes, fuel pump racks, anti-dieseling devices, or any application not requiring more than 10 lbs. pull over ½" stroke. Ruggedly constructed and entirely enclosed for dust and splash proof operation. It is furnished with a mounting bracket and threaded plunger for connecting to operating linkage.

Overall length, plunger out, 4⅛". Overall width of mounting ears 3⅜". Weight 2½ lbs. Special plungers can be supplied if required.

COMPACT • DUST PROOF • LIGHT WEIGHT



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longer engine life

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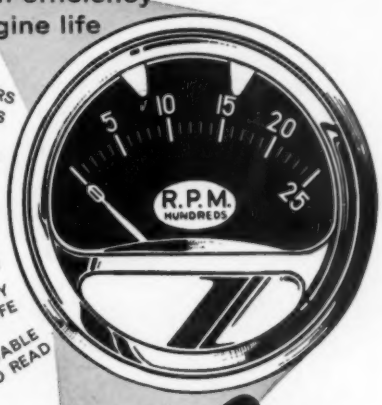

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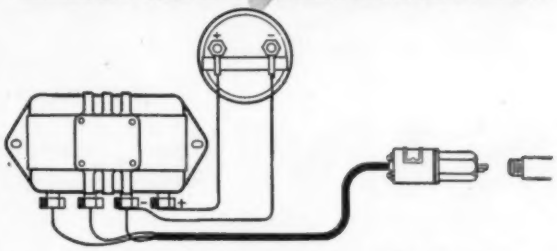

Now, New Sun Mechanical Drive Electric Tachometer for diesel engines gives consistent, more accurate RPM readings for greater diesel efficiency and economy!

Operation is simple and foolproof. The new Sun Power Units are available for standard S.A.E. drive ratios—and S.A.E. mechanical drive outlets. Troublesome, long drive shafts are eliminated. The Sun Transmitter Unit attaches to any S.A.E. mechanical drive outlet where electrical impulses are picked up and transmitted to the Power Unit and then relayed to the "Tach" head in terms of RPM.

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new literature

Evolution of the Crawler

To round off its commemoration of the 50th birthday of the crawler tractor, conducted during 1954, Caterpillar Tractor Co., Peoria 8, Ill. has published a 104-paged hardbound book entitled "50 Years on Tracks."

The picture-laden book is in the form of a series of separate, chronological essays. It opens with an acknowledgement to the predecessors of the first crawler, the combine and tractor, and follows through with each important step in its development, photographically detailed. The growth of such markets as agriculture, logging, and the oil industry receives attention along with the advances.

The first three-fifths of the book covers the company's history in the evolution. The remainder presents the company as it stands today. Here the case method is employed: the reader follows the manufacture of one product, one research-engineering project, one new post-war factory. Similarly, stories are given of one supplier, one domestic dealer, one overseas dealer, one customer, one parts depot, etc., to give a view of the workings and characteristics of the entire industry. Copies are obtainable at about $1.25 each.

Two Marion Films

Two 16-mm sound-color films featuring material handling excavators in action are available from the Marion Power Shovel Co., Marion, Ohio. "The Marion 191-M" shows the large shovel on two crawlers, and "Marion and You" features the company's entire line. The films are offered to organizations upon request.

2-Cycle Turbocharging

Clark Bros. Co., Div. of Dresser Operations, Inc., Olean, N. Y., has issued two new bulletins.

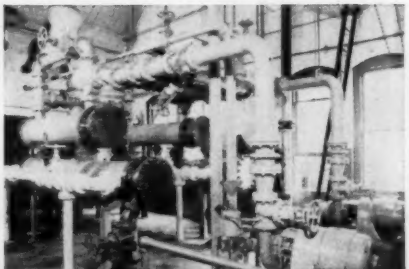
Bulletin 134 covers its new Model TLA turbocharged 2-cycle gas-engine-driven compressors. They are built in three sizes, 2000, 2350, and 3300 bhp, with three, four, and five horizontal compressor cylinders, depending on model and application. Complete feature details, construction, operation, and installation are contained in the 22-page catalog, along with photos and specifications.

Form No. 135 is an article written by a design engineer concerning recent advances in engine and compressor design. Turbocharging, the newest 2-cycle development, is discussed, namely how higher power output has been achieved with lower fuel consumption and greatly lessened cooling requirements. Clark's new turbocharger and new engine designed for turbocharging are considered in the light of meeting the necessary requirements.

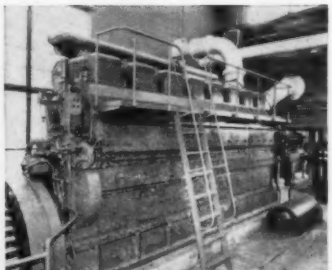
SIMS provides dual service for WORTHINGTON dual fuel diesels . . .

at Clyde, Ohio

4 Sims Heat Exchangers keep jacket water at uniform temperature and engine lube oil cooled to the specified temperature. The City of Clyde enjoys a considerable fuel and operating savings per Kw.-hr. generated because of this well engineered diesel installation. Sims meets Worthington's high standards at the City of Clyde and it's know-how is available to all diesel builders. 16 page Bulletin HR-2, "*Sims Heat Recovery from Internal Combustion Engine*" is available.



2 Sims Jacket-Water Heat Exchangers and 2 Sims Lube Oil Coolers serve 2 Worthington Dual-Fuel Diesels.

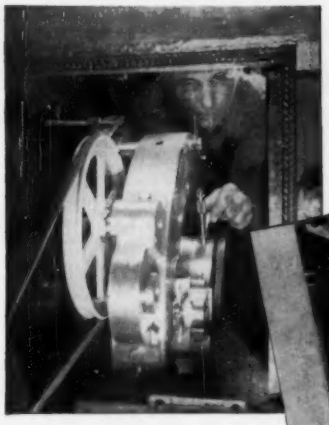


One of two Worthington SEHGO-8 2010 hp. Dual-Fuel Diesels operating at City of Clyde, Ohio.

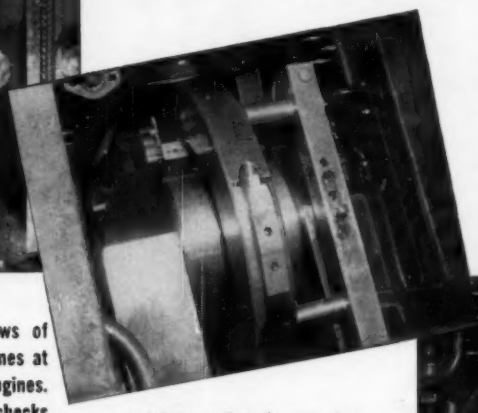
THE SIMS COMPANY • BOX 1096D • ERIE, PENNSYLVANIA

SIMS HEAT RECOVERY EQUIPMENT

HEAT EXCHANGERS • EXHAUST GAS BOILERS • STORAGE WATER HEATERS • DEAERATING AND CLOSED FEED WATER HEATERS • STEAM SEPERATORS • COMMERCIAL TYPE INSTANTANEOUS WATER HEATERS • OIL HEATERS • QUENCHING OIL COOLERS.



CRANK PINS REFINISHED IN PLACE



For engines of practically any size our Portable Machines are available for quick and economical restoration of damaged crank pins. Let us help you minimize down-time.

Requests for the purchase of these machines have become so numerous we have decided to manufacture them for sale and invite your inquiries.

Above illustrations show views of our Portable Crank Pin Machines at work in various size marine engines. At right a marine engineer checks the accuracy of a refinished crank journal.

Additional information furnished without obligation

WASHINGTON IRON WORKS, INC.
Established 1876
SHERMAN, TEXAS

new literature

Magnetic Screw Holders

Magna Drive Corp., 779 Washington St., Buffalo 3, N. Y., has prepared a 24-page manual on magnetic screw holding accessories for power screw drivers and nut setters. Simplified tables are contained to show the selection of the proper magnetic driver or finder after consideration of screw size, type of driving recess, and amount of clearance available. The book also explains how to utilize high energy magnets for holding screws, bolts, or nuts in assembly operations.

Dry-Film Dispersions

How colloidal dispersions are used for dry-film lubrication is described in an illustrated bulletin published by Acheson Colloids Co., Div. of Acheson Industries, Port Huron, Mich. When such solids as electric-furnace graphite, molybdenum disulfide, zinc oxide, and mica are processed to colloidal size and dispersed in liquid carriers, they produce films which are said to be extremely effective over a wide range of operating conditions.

The dry film consists of a microthin layer of particles left on the surface to be lubricated after the volatile carrier has evaporated. Various combinations of lubricating solids and carriers and their specific applications in lubrication are presented in the bulletin.

New Military Problem List

Publication of a list of 109 technical problems confronting the armed services has been announced. Entitled "Technical Problems Affecting National Defense, Supplementary List 1954", it is an addition to an earlier list issued last August.

The new list comprises a variety of inventive fields, including such problems as miniature I-F transformers, high-index transparent plastics, a method of spot- or seam-welding stainless steel, a wind measuring instrument, a windshield rain deflector for aircraft, a mica substitute, a new oxygen mask material, high-temperature resistant tires, and a method for measuring odor. Copies are available free of charge from the National Inventors Council, U. S. Dept. of Commerce, Office of Technical Services, Washington 25, D. C.

Data on Porous Metals

Types, performance, and application data for stainless steel and other metals with controlled porosity are available in a brochure issued by the Pall Filtration Co., 30 Sea Cliff Ave., Glen Cove, N. Y.

Properties of available porous metals, including Type 304 and 316 stainless steels, nickel, monel, stellites, etc., are presented in the 45-page booklet. Included also are data on the various porous stainless steel filter elements and containers manufactured by the company, and their laboratory and plant-scale application. Eight types of filter units for pipeline service are described.

organizational news

Erie Forge Vice President

A. R. Gaus has been elected a vice president of Erie Forge & Steel Corp., according to a recent announcement. Mr. Gaus has been vice president of The Midvale Co. for the past 20 years.

Sales Rep for Detroit Diesel

General Motor's Detroit Diesel Engine Div. has appointed Charles H. Stewart to serve as factory sales representative in the Dakotas, Minnesota, Nebraska, Iowa, Kansas, and the western half of Missouri. He succeeds William R. Bays who is now the GM diesel distributor at Wichita, Kans.

Mr. Stewart was formerly service representative for Detroit in the Texas zone and has been with the division since 1946. During World War II he served as instructor of diesel servicing and maintenance in the Army Ordnance Dept.

Federal-Mogul Changes

Walter T. Camp has been named Chicago district manager of Federal-Mogul Corp.'s service division to succeed Harlan C. Skinner who died unexpectedly. Lee Gruennert will take over Mr. Camp's former post of Dallas district manager.

W. T. Camp

L. Gruennert

Mr. Camp has been with Federal-Mogul for 17 years. He first served as a salesman in the company's San Francisco district, later becoming manager of that district. In 1952 he was placed in charge of the Dallas district.

Mr. Gruennert became associated with the company in 1930, in its San Francisco division. He helped establish a service branch in Los Angeles and in 1937 moved to Seattle to establish a warehouse, managing that territory until his transfer as Portland manager in 1948.

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DIESEL SHOP MANUAL

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- Diesel Compression Testers
- Nozzle Testers for American Bosch, Caterpillar and Bendix Nozzles
- Cummins Injector Tester
- International Harvester Injection Testers
- General Motors Injector Testers
- Injection Pump Calibrating Stands
- Nozzle-Injector Cleaning Tools and Lapping Blocks
- Engine Overhaul Stands
- Engine Removal and Parts Dollies
- GM 71 Engine Tools

76 Pages—275 Illustrations
56 Engine Reference Tables
26 Parts Lists

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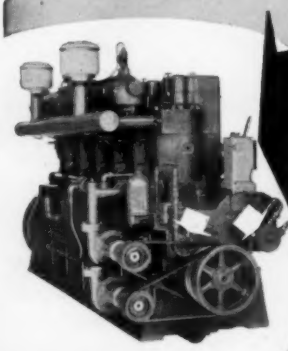

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It Pays to Specify

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For dependable lubrication of diesel engines and power units, Tuthill offers a complete line of positive displacement pumps, designed for lubricating and scavenging. Included are automatic reversing pumps and stripped models for built-in applications.

Write for the Tuthill Pump Guide listing all Tuthill Pumps for lubricating requirements. Send specifications for quotation.

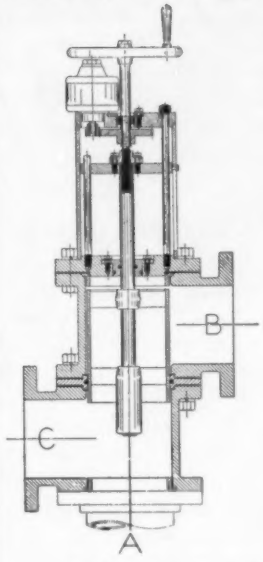
TUTHILL PUMPS FOR EVERY PURPOSE

TUTHILL PUMP COMPANY

Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Ill.

Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

AMOT LARGE MODELS



AMOT model D 3-way thermostatic valves will give excellent automatic temperature control for engine jacket water on header type systems using several engines connected to the same water header.

Features are as follows:

1. 6" to 36" pipe sizes
2. Balanced valve
3. Full modulating control
4. Air motor operated
5. Low pressure drop
6. Adjustable sensitivity
7. Valve position indicator
8. 2-way model also available

Write for literature and name of your nearest AMOT representative.

AMOT CONTROLS CORP.

RICHMOND 1, CALIF.

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DIESEL

indicator valves

OPERATES AT PRESSURES UP TO 10,000 PSI

Kiene valves have effective gas seal both open and closed without packing or glands. Operate against pressure — will never blow open. Small and rugged — 4¼" in length with only 3¼" circle of space for attachment. Kiene valves give better service under the most severe conditions. Standard indicator plug and wing nut connection.

Furnished with male ½" NPT engine connection. Other threads on order. Adaptations for most diesel locomotive engines.

SEND FOR BULLETIN V-10

KIENE DIESEL ACCESSORIES, INC.

10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

P. O. Peterson

New Mack President

P. O. Peterson has been elected as president and chief executive of Mack Trucks, Inc. by its board of directors. E. D. Bransome, retiring president, continues as chairman of the board.

Mr. Peterson takes his new post from the position of executive vice president of Studebaker-Packard Corp. He has spent his entire career in the automotive industry.

Atlantic Assistant Manager

Atlantic Mfg. Co. announces appointment of Gaspar G. Sachetta as assistant general manager. He was formerly plant manager of the diesel and gasoline generator set manufacturing and sheet metal fabrication division. Before that he was associated with Price Battery Corp., A. S. Campbell Co., and H. K. Porter Co.

Alfred Tickle Dead

The president of Arthur Tickle Engineering Works, Alfred Tickle, has died at the age of 62. He was the son of the late Arthur Tickle, founder of the company. His two brothers, Howard B. and Arthur B. Tickle, Jr. survive him as officers of the company.

Alfred Tickle

Exide Has New President

Carl F. Norberg has taken over the post of president of The Electric

C. F. Norberg

Storage Battery Corp. following the resignation of S. Wyman Rolph who is retiring after 38 years of service.

Mr. Norberg first became associated with the company when he joined Willard Storage Battery Co., then a subsidiary, in 1925.

After successive executive positions, he was transferred to the parent company in 1943 and was made vice president of manufacturing in 1944. He was elected a director in 1948 and in 1950 was named executive vice president, the position he held until his election to president.

How much of your engine maintenance bill is due to repair of breakdowns that could have been avoided—*if you'd had advance warning?*

At a fraction of that cost, Alnor Exhaust Pyrometers offer you a constant check of engine performance—advance warning of

Cylinder Overload **Preignition**
Scaled Jackets **Clogged Ports**
Detonation **Faulty Injection**

Get the best from your diesel—minimum fuel consumption per horsepower and long service uninterrupted by foreseeable breakdowns. Get constant protection of your engine, cylinder by cylinder, with an Alnor engineered Exhaust Pyrometer System.

Get Full information—Quickly! Your nearby Alnor Diesel specialist is conveniently listed in the classified directory. Ask him to help you select the Pyrometer and thermocouple assembly designed for your engine. Or send for Bulletin 4361 with complete details of the full Alnor line of Pyrometers.

ILLINOIS TESTING LABORATORIES, INC.
Room 507, 420 N. La Salle St., Chicago 10, Illinois

news of our industry

Establish Dilworth Fellowship

Richard McLean Dilworth, chief engineer for a quarter of a century of Electro-Motive Div. of General Motors, now retired, was honored at a dinner in Chicago where notables assembled to hear announcement of the establishment of the R. M. Dilworth Fellowship. The 4-year fellowship was presented by EMD to the Illinois Institute of Technology for the study of sound control in diesel engines.

R. M. Dilworth

Coincident with the fellowship, the publication of a biography of Mr. Dilworth was announced. It discloses colorful phases in the life of the man who is generally credited with being the engineering genius behind the diesel locomotive. It was Mr. Dilworth who supervised the designing, production, and testing of the first successful GM diesel passenger locomotive and later solved the problem of developing a diesel freight engine.

Aluminum Coating Technique

Aldip, a method of coating aluminum to steel, developed by GM Research Laboratories, was recently reported as having successful application to automotive engine intake and exhaust valves. Originally developed to protect against oxidation and corrosion, especially at high temperatures, it has been used on exhaust manifolds, heat exchangers, and turbine engine components. However, this latest application is the first for moving parts of an engine.

The original method required a dipping operation which the new method eliminates. Aluminum is sprayed on the steel part and then the part is heated in a flux bath until the aluminum melts. Road tests have indicated that the valves lasted more than twice as long as uncoated valves of the same steel composition. The successful use of the process, the same as used by GM's licensee, Arthur Tickle Engineering Works, points the way to wide application in the diesel field for today's high out-puts and temperatures.

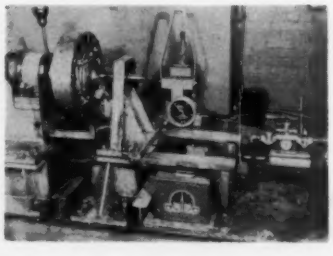
New Texas Line for Santa Fe

The Santa Fe Railway System Lines announces it has accepted an ICC certificate authorizing construction of a new 48-mi line of railroad into Dallas, Tex., with work on the project to start immediately. Estimated cost of construction is $6½ million. This will provide Dallas with a new streamline passenger train service and also expedite movement of freight over a direct northerly route.

Testing Truck Clutches

A test has been developed by Lipe-Rollway Corp. for heavy-duty truck clutches. It makes use of a traction dynamometer produced by W. C. Dillon & Co., manufacturer of production control equipment. Use of the dynamometer is said to provide exact knowledge of clutch release bearing loads imposed and also speed up the testing operation.

As shown in the accompanying picture, the dynamometer is inserted in the linkage used to release the test clutch on the torque test stand. Force in pounds is indicated on the dial, and when corrected for lever ratios, release bearing loads are obtained as the clutch is rotated up to 2400 rpm. This is comparable to actual clutch operation in a vehicle. The dial may be factory-set at positions to meet demands of various test requirements.



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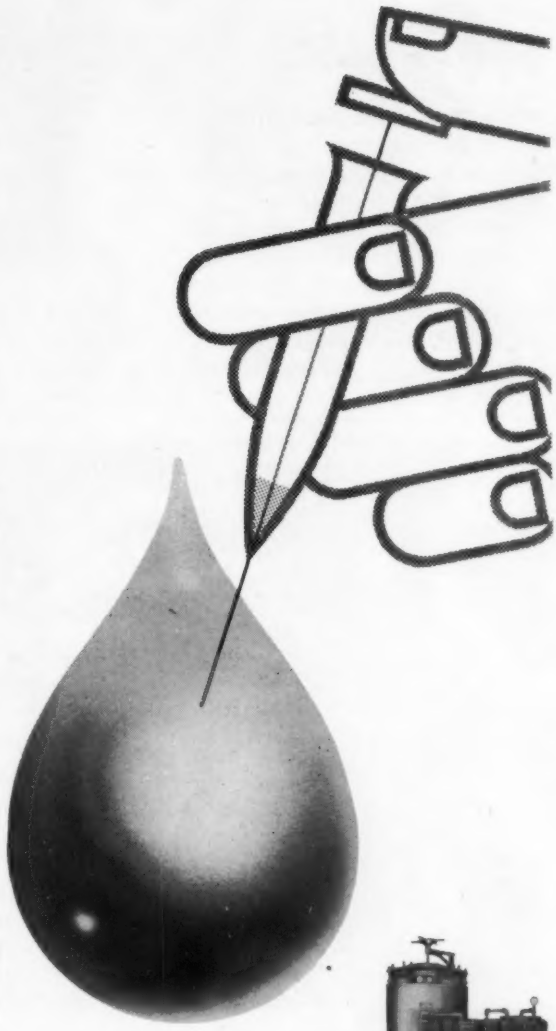

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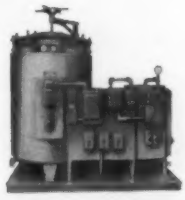

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This combination cartridge filter and vaporizer not only filters out organic acids, resin, gums, asphaltenes and other oxidation by-products . . . but also eliminates fuel dilution and soluble moisture.

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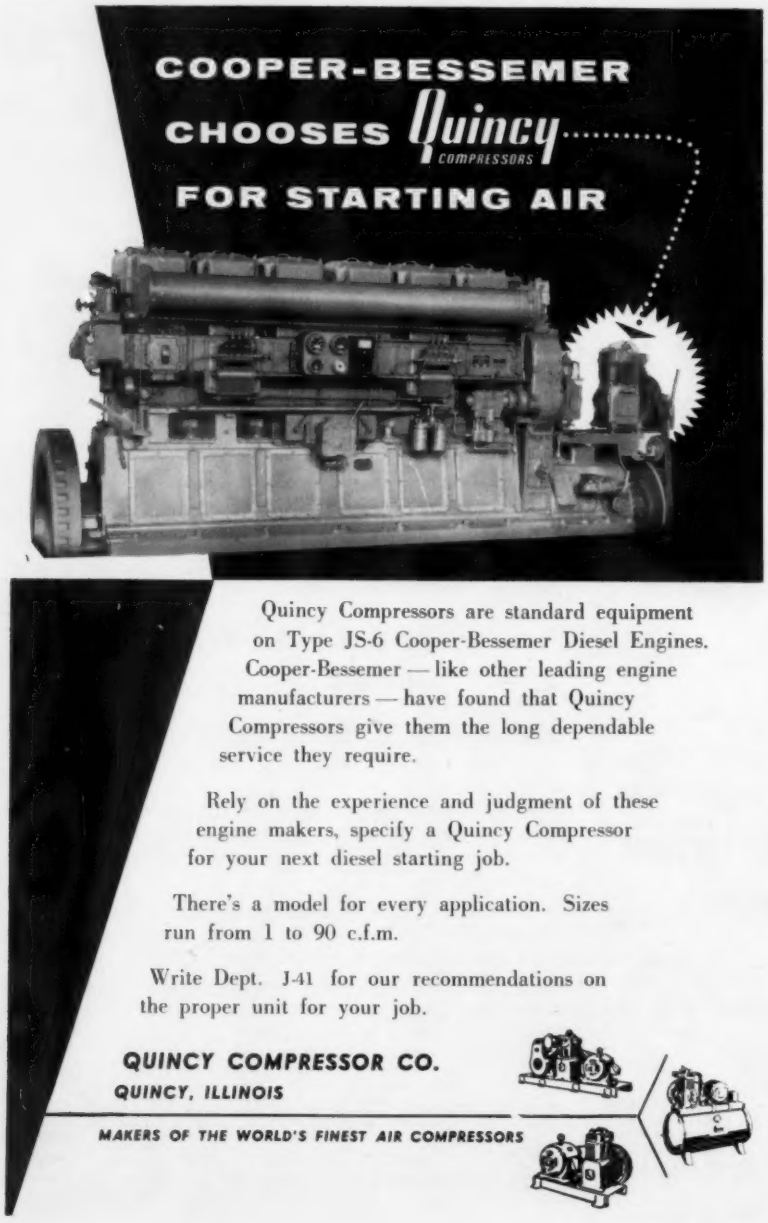
new products

Mechanical Drive Tachometer

Now available from the Tachometer Div., Sun Electric Corp., Harlem and Avondale Aves., Chicago 31, Ill., is a mechanical drive electric tachometer and transmitter unit designed for diesel engines, said to be adaptable to most diesels in commercial and marine service. There are no drive cables. The tachometer head may be up to 100 ft from engine.

Units are available for standard SAE drive ratios and SAE standard mechanical drive outlets. The transmitter unit attaches to the drive outlet and electrical impulses are picked up and transmitted to the power unit, then relayed to the tachometer head in terms of rpm.

The head has an illuminated dial with adjustable arrows to indicate safe rpm range. Accuracy is claimed to within 2% of full scale value. Catalogs for complete information are available upon request to the company and its distributors.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Tool Set Units

Development of five Proto Adda-Units, each containing tools in a plastic holder, has been announced by the Plomb Tool Co., Washington & Santa Fe, Los Angeles 54, Cal. They are designed to enable the building up of a master set of tools as the budget permits.

The first five units include No. 9931 which contains five open-end wrenches; No. 9937 having six combination box and open-end wrenches; No. 9942 with two adjustable wrenches and two pipe wrenches; No. 9950 containing a hinge handle and 10 ½-in drive socket wrenches; and No. 9953 holding four pliers: a thin nose, a midget, a compound leverage, and a general utility.

New Seals for Viking Pumps

Viking Pump Co., Cedar Falls, Iowa, announces that its heavy-duty and normal-duty pumps are now available with mechanical seals in sizes from 10- to 300-gpm capacities. The heavy-duty pumps are suitable for pressures up to 200 psi on lubricating liquids and 100 psi on non-lubricating liquids. Pressures up to 100 psi on lubricating liquids and 50 psi on non-lubricating liquids are suitable for the normal-duty pumps.

The new seals are constructed of iron and steel with Buna "N" synthetic rubber parts for use on standard-fitted, all iron, steel-fitted, and bronze-fitted pumps. For all bronze pumps, the seal is of bronze, stainless steel, and ni-resist construction with Buna "N" synthetic rubber parts. Chief advantages claimed are leakless operation and elimination of need to pack pumps. The pumps have carbon graphite bushings to eliminate external oiling, replacing bronze bushings.

new products

Welding Steel to Cast Iron

Basis of a new technique for welding steel to cast iron is a recently developed electrode having a bimetallic core of copper and mild steel with arc-shielding flux coating. In operation it is said to be similar to arc welding of mild steel with coated electrodes, the arc fast and smooth and the deposit flowing freely.

Welders of average skill are claimed able to accomplish good bonding with the rod. The deposit has a slight copper color, is said to show a tensile strength much higher than cast iron, to be tough and ductile, and highly resistant to shock. The deposit is also peenable and is free from cross checking.

Designated the 100-X electrode, it is available in 1/8-, 5/32-, and 3/16-in sizes from C. E. Phillips & Co., 2750 Poplar St., Detroit 8, Mich. Scope of the electrode includes repair welding on all grades of iron castings, welding cast iron to carbon and alloy steel, welding heavy cast iron sections without studding, and welding copper to cast iron. Welds can also be made in all positions and overlaid with mild steel or nickel alloys.

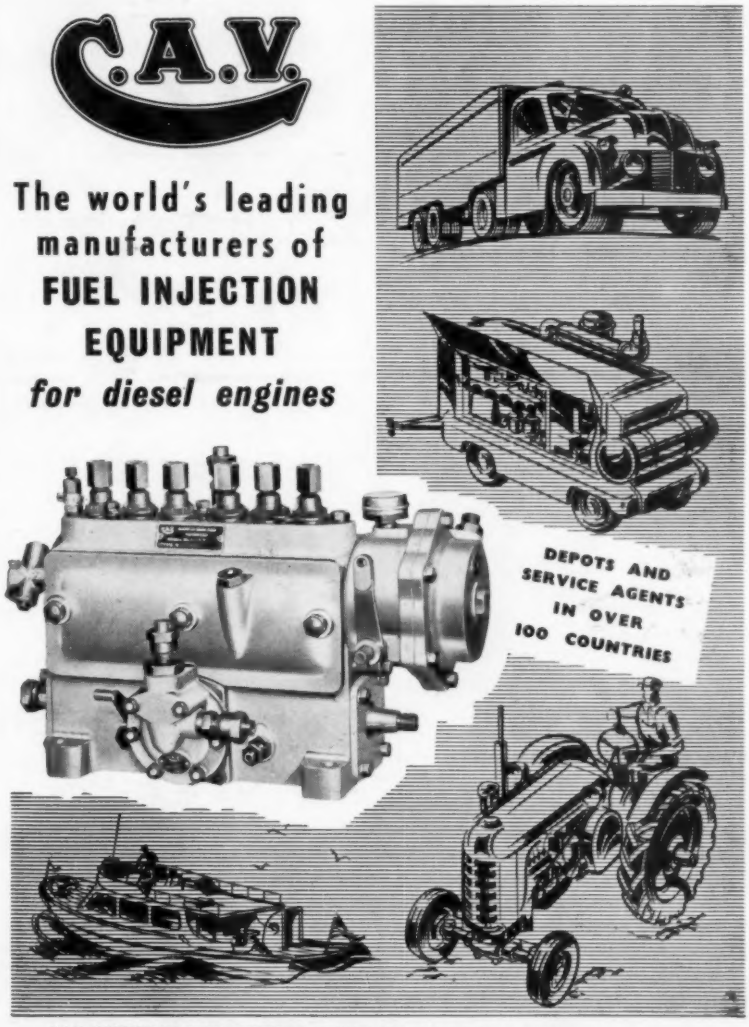
Heavy Bar-Type Puller

Snap-on Tools Corp., Kenosha, Wis., announces it is making available a heavy bar-type puller set providing up to 50-ton power for big machinery jobs. To take the stresses and strains of breaking loose and removing rusted-on or tightly fitted parts, it is rigidly built and specially heat-treated.

The 16-in long yoke is machined from 2½-in square stock, with grooves for side rods extending to within a short distance of the center pressure screw so objects can be pulled with openings or tapped holes a minimum of 6-in apart, center to center. The side rods are threaded at both ends for ease in setting up the puller. Two short extension rods, 9-in long, and two long extension rods, 18-in long, are included in the set.

Where additional reach is necessary to remove an object set far back on a shaft, the rods can be threaded together by means of connecting nuts, having a stop in the center so that both screws will be threaded an equal amount. An extra set of nuts is included to make the unit adaptable for pushing or pulling. These can be threaded on the rods to contact the underside of the yoke.

Tightening the top nuts locks the rods and yoke together in a single unit. Two adaptor blocks, 8 in by 2½ in by 1¼ in, can be slid over the side rods and then held back of the wheel by two nuts to provide additional bearing surface and allow the puller to adapt to almost any type of wheel construction.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news of our industry

Caterpillar Ups HP Ratings

Recent engineering developments at Caterpillar Tractor Co. have increased horsepower ratings for D397, D386, D375, and D364 diesel engines. Continuous ratings of the engines will be up to and including 1200 rpm. The intermittent curve has been extended to 1300 rpm.

In the order listed above, continuous ratings without radiator fan are 450, 360, 302, and 238 hp. With radiator fan, ratings are 430, 340, 284, and 220 hp. Intermittent ratings in the same order without radiator fan are 520, 415, 350, and 275 hp. With radiator fan, ratings are 493, 388, 328, and 253 hp.

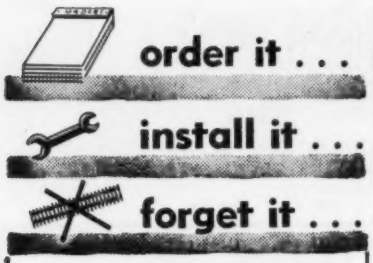
As diesel-electric sets, at 1200 rpm without radiator fan, the engines offer continuous ratings of 315, 250, 210, and 165 kw. With radiator fan at 1200 rpm, ratings are 295, 230, 200, and 155 kw. At 1000 rpm, without radiator fan, ratings are 275, 215, 173, and 140 kw. With radiator fan at 1000 rpm, ratings are 265, 205, 173, and 135 kw.

Diesel Fuel Storage Test

The Naval Research Laboratory reveals it has completed preliminary studies using a light-scattering technique on diesel fuels. First results indicate that it may be possible to predict, after a test period of a few days, how various diesel fuels will stand up under extended storage periods. The technique makes use of the fact that sub-microscopic particles suspended in the fuel will scatter light passed through the liquid. The test is also said to appear useful in evaluating fuel stability additives.

New B-W Torque Converter Line

Borg-Warner Corp. announces that it will extend its line of torque converters to the manufacture of tailored units for industrial applications. An expanded engineering force has been established at its Long Mfg. Div. for research and development work.



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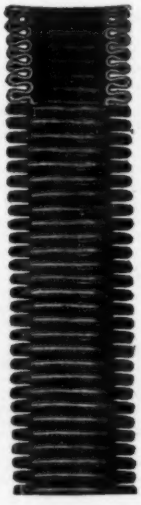

Diesel Bulletins 1020 & 50A furnish complete information.

See our Catalogs in Sweet's Files for Product Designers and Mechanical Industries.

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What Do You Know!

(*Answers to Questions on Page* 35)

1. Correct answer is "a". This leeway will permit the corrugations to provide the necessary "bellows" action without undue stress. For details concerning flexible metal hose, see the article on Page 39.

2. Correct answer is again "a". In fact, long sections of flexible metal hose should be given additional support just as would a long length of rubber hose. For details, see article mentioned above.

3. Both "a" and "b" are correct. In respect to "c", heavy fuels have a high specific gravity approaching, and in some cases exceeding, unity. See the article on Page 46.

4. Correct answer is "b". An advantage of this design is that it eliminates complicated coring of water passages as would be the case in a solid piston. Here, passages are machined and are known to be uniform. See Page 42 for details.

5. Correct answer is "c". Where stray currents are known to exist, interruption of their circuit is a practical solution. This along with other electrical data is discussed in the article on Page 33.

6. Correct answer is "a". This is considered to be the safe minimum value allowable for generators in service. For details, plus data on other tests, see article mentioned above.

7. Correct answer is "b". Pressure drop through the filter is dependent upon both the density of the filter media selected and the area. For an example of a high-efficiency, low-restriction, dry-type filter, see the article on Page 38.

8. Correct answer is "b". Recent tests with a new fuel injection pump have shown little if any advantage in varying injection timing at engine speeds below 2000 rpm. See Page 24 for details.

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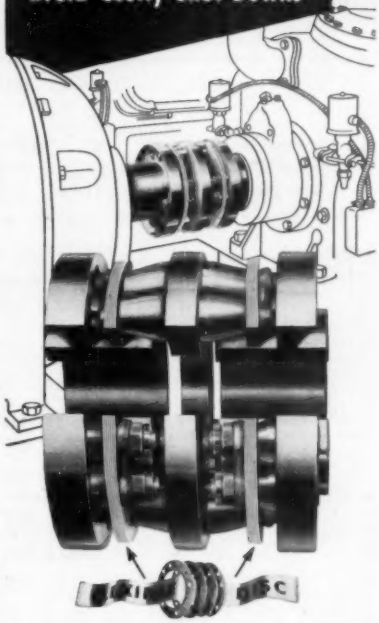

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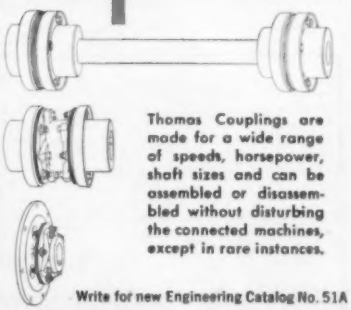

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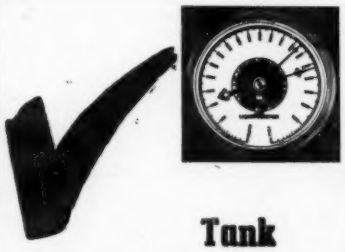
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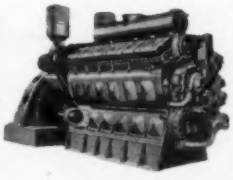
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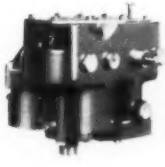

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Perhaps you would like to know more about STANDARD HD Oil. In the Midwest a call to your nearby Standard Oil lubrication specialist will bring a prompt response. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

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